COMPUTE!'s GAZETTE

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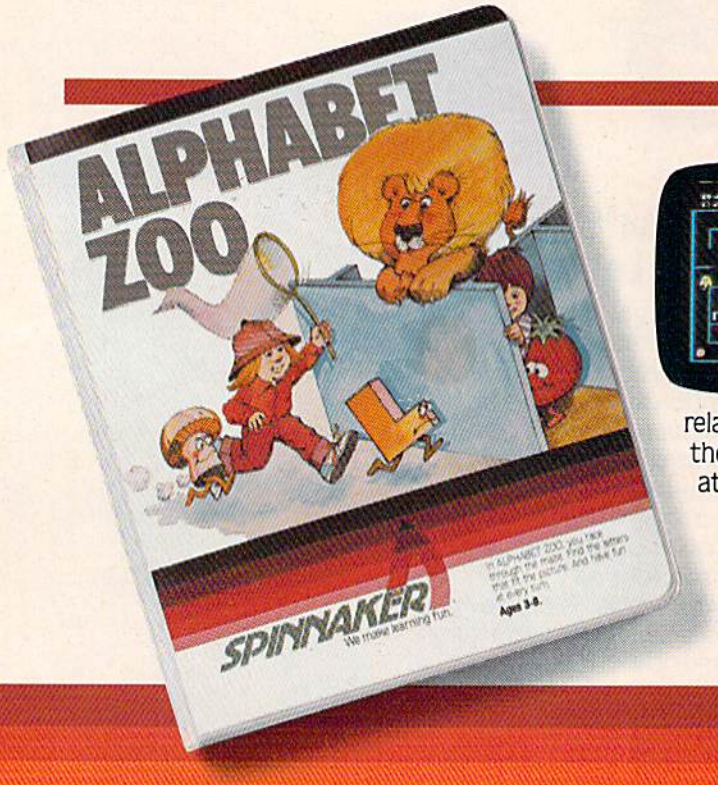

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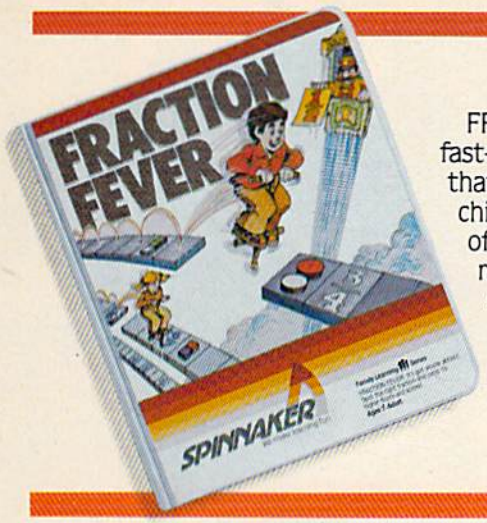

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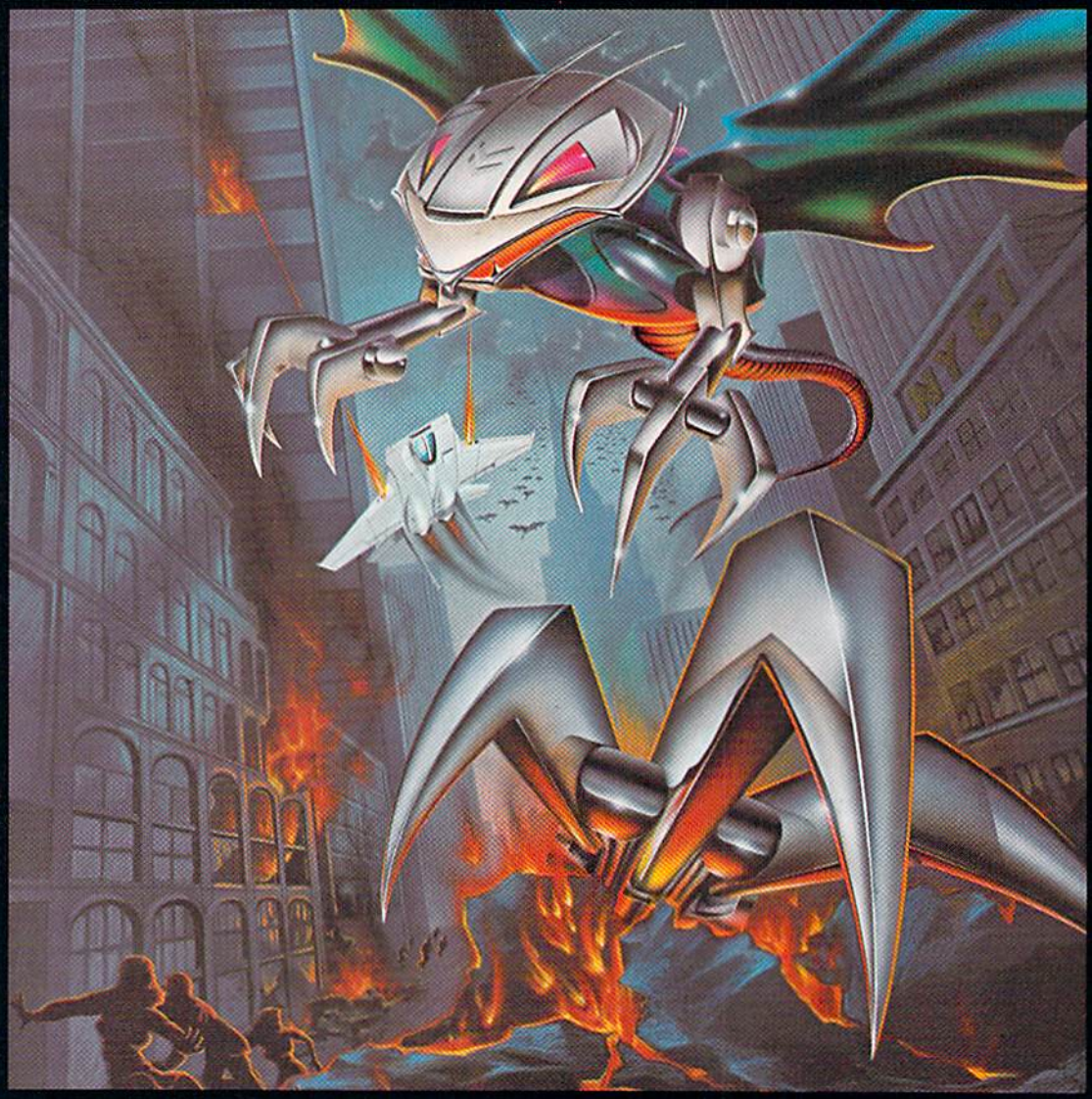

It was as peaceful a day as New York ever gets, when suddenly the sky went dark and a monstrous droning noise filled the air. Hordes of grotesque aliens were swooping down from all sides, biting into the Big Apple as if they hadn't eaten for days. They were laying eggs, too. Horrible slimy things that got down into the subway tunnels and began clawing their way up. If anyone was going to save the city, it would have to be me. I leapt into my rocket and began blasting away. I thought I stood a fighting chance, but fuel's running low... another wave of invaders on the horizon... signing off...

SAVE NEW YORK.™ For the Commodore 64.

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THE EDITOR'S *notes*

We welcome Lance Elko as editor of COMPUTE!'s GAZETTE. Tom Halfhill, former editor of the GAZETTE, has moved into the position of editor of our newest magazine, COMPUTE!'s PC & PCjr. Lance, a native of Philadelphia, joined us last May as an assistant editor in the magazine division, eventually becoming assistant editor of the GAZETTE. As editor of the GAZETTE, Lance will continue to bring you the same clarity of style and solid content that you expect in the GAZETTE.

Exciting news for those of you who've grown tired of typing in our extensive applications and games software. Beginning with the April issue of the GAZETTE, we'll have monthly disks available that contain all of the software printed in each issue of the magazine. We've been working on this task for some months now, with two primary goals in mind. First, we knew we had to insure the quality of the disk that's delivered to you each month, and second, we wanted to find a way to do this as inexpensively as possible. Our goal was to make it so easy to accomplish that it would become a truly broad-based method of distribution of our highly useful software.

We'll give you full details in the March issue of the magazine, but for now here's where we are. Subscribers will be able to enter a six or twelve month subscription to the disk series. The disk corresponding to each issue of the magazine will be released in time to arrive by first class mail as close as possible to the arrival date of your magazine. The magazine will contain all of the descriptive information and articles as well as the documentation for each program. Full listings will, of course, continue to appear in the magazine. The magazine itself *will not change*; we'll simply have all of the monthly software available on disk as well. For those of you who wish the convenience of not having to enter programs, we'll have the solution.

You regular newsstand buyers will have the option of ordering each month's disk when you purchase the magazine. Individually ordered disks will be available for shipment to individual orderers approximately one week after the magazines arrive at dealers and newsstands. Disks will not be available for sale at retail outlets.

Here's how the disk subscription will work. If you wish to start with the April disk, you'll need to send in the special renewal card that will be bound in the March issue. You will have to do this *as soon as you receive* your March issue of the magazine. This card will do two things. It will extend your subscription period to coincide with the disk subscription period. Also, it will activate your disk subscription to insure that you receive the first disk issue. Currently, the "alternate media" subscription will be available *only* on disk. Note that if you order a one year disk subscription, and have only eight months left on your magazine subscription, it will be necessary to extend your magazine subscription by four months to match the twelve month disk subscription. The cost of the magazine subscription is not included in the cost of the disk subscription.

We'll have all the final details in the March issue. Remember, it will be very important (if you wish to be included in the first run of April disks) to complete and return the appropriate card immediately upon receipt of your March issue. We're certain that you'll find the disks quite convenient.

Editor In Chief

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GAZETTE FEEDBACK

EDITORS AND READERS

Do you have a question or a problem? Have you discovered something that could help other VIC-20 and Commodore 64 users? Do you have a comment about something you've read in COMPUTE!'s GAZETTE? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403.

Limiting Memory

I would like to know why some of your programs limit the top of memory (with a POKE 56,xx). It seems to me that these POKEs could be left out of the program.

Mike Carroll

In both the VIC and 64, memory locations 55 and 56 are used as a pointer *to the top of BASIC memory. This means that they contain the address (plus one) of the highest memory location that can be used by BASIC. There is an equivalent pointer to the bottom of memory (locations 43 and 44). You can find out where BASIC begins and ends with these formulas:*

```
PRINT PEEK(44)*256+PEEK(43): REM BOTTOM OF
  MEMORY
PRINT PEEK(56)*256+PEEK(55): REM TOP OF
  MEMORY
```

The reason for changing one of these pointers is fairly straightforward. When you write a BASIC program, the computer stores it in Random Access Memory (RAM) beginning at the address in the bottom of memory pointer. Sometimes you need to create a safe area of memory which BASIC cannot disturb, as, for example, when you want to include a machine language subroutine or a redefined character set with your BASIC program. You could create this safe area by raising the bottom of memory (increasing the value of the pointer in locations 43 and 44), but it is far more common to lower the top of memory by changing the values in locations 55 and 56. If you want to reserve some even multiple of 256 bytes (called a page *of memory), you need POKE only location 56. The POKE to location 56 works by fooling BASIC into thinking that RAM ends before it really does.*

Actually, VIC and 64 programs which limit the amount of memory available to BASIC with a POKE to location 56 should also POKE location 52 with the same value. The reason for POKEing location 52 is more subtle, and requires an understanding of how Commodore BASIC manipulates variables. Briefly, as a BASIC program runs, it tends to put variable values into the area of memory starting at the end of the program and ending with the address contained in locations 51 and 52. The address in locations 51 and 52 can be thought of as the "top of memory for variable storage" pointer. If you don't want BASIC variables to destroy the data you store at the top of memory, you must POKE location 52 along with 56.

An example of this is the "Spike" game (COMPUTE!'s GAZETTE, December 1983). That machine language program resides at the top of the BASIC memory area, but no POKEs were made to protect it. As you type in the numbers for Spike, the variables for the BASIC "MLX" program overwrite your typing. Spike can be protected from BASIC by moving the top of memory and the top of variable storage to below the start of the machine language. Do this by typing POKE 56,128:POKE 52,158:CLR before running MLX.

Note that memory restrictions created by POKEing locations 52 and 56 remain in force even after you type NEW or hit the RUN/STOP and RESTORE keys. Turning the computer off and back on will restore the normal values.

How The Computer Stores Data

I'm confused about how the computer stores DATA statements for machine language programs. You published a program with DATA 157, 0, 4 (STA 1024,X). Does the computer store in hex? I know STA uses a 16-bit address and that 1024 (decimal) = $0400 (hexadecimal).

Kenneth L. Marvin

The computer stores numbers only in binary. When you POKE a number into memory, you use decimal, but the number is stored as binary (base two); the bits are on or off. At the lowest level, everything is either a one or a zero.

Random Access Memory (RAM) contains many on-off switches, which by themselves do nothing. The computer also contains a Central Processing Unit (CPU) which interprets certain bit patterns as machine language instructions. This is what gives it the power to compute.

When the CPU sees 10011101, it interprets it as the instruction STore Accumulator. The computer only cares about the binary number. It's up to us whether we want to interpret the number as 10011101 (binary) or as $9D (hexadecimal) or as 157 (decimal).

See the series of articles "The Inner World Of Com-

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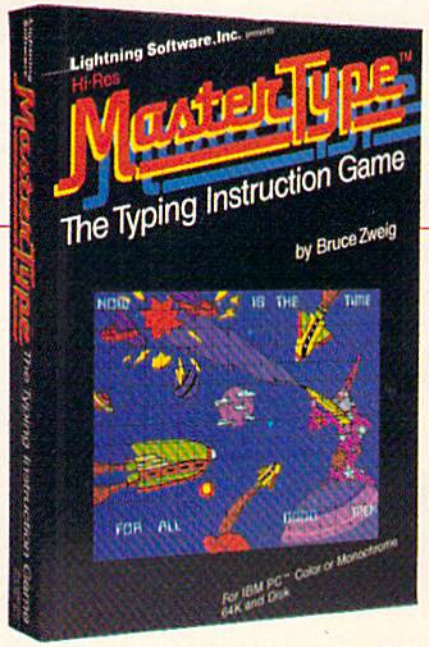

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puters," which began with the November 1983 issue of GAZETTE, *for more information on how the computer stores numbers.*

Abbreviating The IF-THEN Statement

I have run into what seems to be incomplete IF-THEN statements like this:

```
20 IF A THEN 100
```

I don't understand what the IF is checking. I have seen this in more than one program, but I can't figure it out.

Guy Richards

IF-THEN statements are used to test for a certain condition and to take action only if the condition is true. They operate logically: IF (something is true) THEN (do something). When you use IF-THEN, you are checking the truth *of an expression (a variable or equation). IF the condition is true, THEN the program executes a command.*

```
IF X=5 THEN Y=15
IF X=5 THEN PRINT "GAME OVER"
IF X=5 THEN 200
```

The three examples above check the value of variable X. If X equals 5, different actions are taken. In the first example, if X=5, then the value of Y is set to 15. In the second example, the line performs a BASIC command (PRINT) if X=5. The third example could have been written IF X=5 THEN GOTO 200, but it works just the same without the GOTO.

In the line mentioned in your question, the IF statement is checking the variable A. IF A (is true) THEN (GOTO) 100.

How can a variable be true or false? The computer decides that if a variable has a value of zero, it is false. If the variable has any other value, it is true. When the BASIC interpreter sees IF A (without an equation), it checks to see if A is zero or nonzero. When you see a line like IF A THEN 100, you can read it as IF A (does not equal zero) THEN (GOTO) 100.

Some beginning programmers inadvertently make mistakes when they use IF-THEN as part of a multiple-statement line. When an IF-THEN is followed by a colon and another BASIC statement, the BASIC statement becomes part of the THEN section. Watch out for lines like this:

```
10 IF A<15 THEN 100: PRINT"YOU HAVE A VERY
   GOOD SCORE!"
```

The computer checks to see if variable A is less than 15. If it is, it goes to line 100. If it is not less than 15, it will skip the rest of the line. The program will never get to the second part of the line (the PRINT command). If an IF-THEN statement is not true, the program moves on to the next line.

A Different Kind Of GET?

I can't seem to use GET statements in my Commodore 64 programs. I used the following line in a program on the Apple: 210 IF I=15 THEN GET W$. This line causes the Apple to wait until a key is pressed. But the 64 does not wait. What's going on?

Anthony Perry

Apple BASIC and Commodore BASIC are two dialects of the same programming language. There are a few commands and statements that seem to do the same thing, but don't. The GET statement is a good example.

On the Apple, GET will wait until a key is pressed. On the 64, GET checks to see if a key is pressed, but it won't wait. If you don't type anything, the program continues.

If you want your 64 to wait, use the following line:

```
10 GET G$: IF G$="" THEN 10
```

Make sure you use two double quotes, with no space between them. The two adjacent quotes represent a "null" character, meaning that nothing was typed in. As you can see, if no keys were pressed, the line repeats over and over again. When you type something, the program continues.

When you learn one version of BASIC and then use a different brand of computer, it is a good idea to read the programming manual to find differences in the BASIC dialects. If you compare Apple and Commodore, you will find that most of the commands are exactly the same. But there are a few that can fool you.

Mixing Uppercase And Lowercase Letters

How do you get capital letters on the same screen with small letters?

Shane Genis

Capital (uppercase) letters and small (lowercase) letters are found in different modes on the VIC and 64. When you first turn on your computer, it is in uppercase/graphics mode. Any letter you type will be in uppercase, and when you press SHIFT and a letter, you'll see the graphics character assigned to that key.

The simplest way to get into lowercase mode is to hold down the Commodore key (on the bottom left of the keyboard) and press SHIFT at the same time. Now, all the letters you type are lowercase. To get capital letters in this mode, just hold down SHIFT and type a letter. To get back to uppercase/graphics mode, just press the Commodore key and SHIFT again.

Although this is the simplest method, it won't work while a program is running. If you're writing a program in which you want to include a switch to uppercase or lowercase mode, you must use these statements:

```
PRINT CHR$(14):REM SWITCHES TO UPPERCASE/
  LOWERCASE
PRINT CHR$(142):REM SWITCHES TO UPPERCASE/
  GRAPHICS
```

There are times, too, when you might want to

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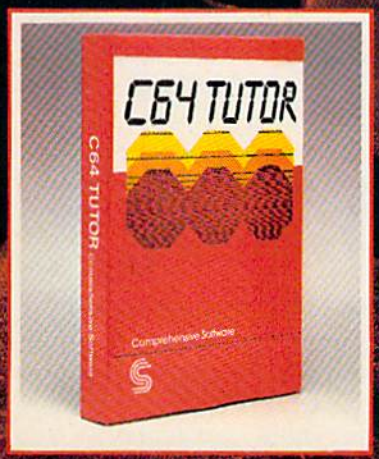

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disable this mode-switching function. For example, if you're writing an educational game for small children, you wouldn't want a child to accidentally press the Commodore key and SHIFT and see all your graphics characters change to letters. To prevent this, use these statements in your program:

```
PRINT CHR$(8):REM DISABLES CHARACTER
  SHIFT
PRINT CHR$(9):REM ENABLES CHARACTER SHIFT
```

CHR$(8) disables the Commodore/SHIFT function, but it also prevents any further use of PRINT CHR$(14) and PRINT CHR$(142) until a CHR$(9) is PRINTed. Many programmers make it a practice to include a line at the beginning of their programs to disable character shifts—a good safeguarding technique.

A Computer Rounding Error

When I tell my VIC-20 to PRINT 158.41–50, it answers 108.41. But when I tell it PRINT 158.41–150, it answers 8.40999997. What is the malfunction?

Peter Buyaki

Computers never make mistakes; only people do. Right? Wrong.

You are the victim of a rounding error. The VIC-20 and most other computers use the binary system for mathematical calculations. While some numbers translate easily to binary, some do not. The same is true of decimal (the numbering system we're used to). The fraction ⅓ translates into 33 percent (after rounding off all those extra threes). And three times 33 percent comes to 99 percent. The result is off by 1 percent.

Assuming you were performing a financial calculation, your result was off by only three millionths of a penny, which should be accurate enough for most purposes.

You will never be able to translate ⅓ into a perfect percentage (in decimal). And your VIC will never be exactly accurate when it uses certain fractions.

If you would like your program to round to the nearest penny, use this formula:

```
X=INT(X*100+.5)/100
```

Or, if you want to use this often in your program, you can define a function that does it for you. It will save some memory if you use it frequently.

```
DEFFNR(X)=INT(X*100+.5)/100
```

If you DEFine the function at the beginning of a program, anytime you want to round a number, use FNR. For example, if the variable you want rounded is QP, you would use QP=FNR(QP).

The RND Function

I see the functions RND(0) and RND(1) in many programs. What is the difference between the two?

David Jennings

RND(0) will generate a random number directly from the jiffy clock (an interval timer built into your computer). RND(1) will create a random number based on the last number generated by RND. If you use a negative number in parentheses, the computer will give you a predetermined (not really random) number.

Because computers are designed to be logical, they cannot make up truly random numbers. When you use the RND (RaNDom) function, a number is generated by a mathematical formula which starts with one number and gives back another. The number in parentheses is called the seed. *The value and sign of the seed affect what kind of random number you get.*

If the seed is a positive number, the value will not matter. A positive seed will make up a random number from the last value. Try typing in the following program line:

```
10 FORX=1TO5:Y=RND(1):PRINTY:NEXT
```

When you type RUN, it will print five random numbers on the screen. If you RUN it again, you'll see a different set of random numbers.

Using a negative number as the seed will result in the same number every time. Add this line to the above program:

```
5 S=RND(-1)
```

Now when you RUN the program, you'll still get a list of five numbers. But RUN it again and you'll see the same five numbers. Using a negative number predetermines the series of random numbers. Your computer uses a formula to create random numbers (which is why they are sometimes called "pseudo-random").

A negative seed is sometimes handy when you are debugging a program or running a benchmark test. If you want random numbers, but always want them to appear in the same order, use a negative number the first time you use the RND function, and a positive seed in subsequent lines.

When the seed is zero, the computer uses the current value of the jiffy clock, which is updated 60 times every second. This gives you a way of randomly seeding the RND function.

Merging Two Programs

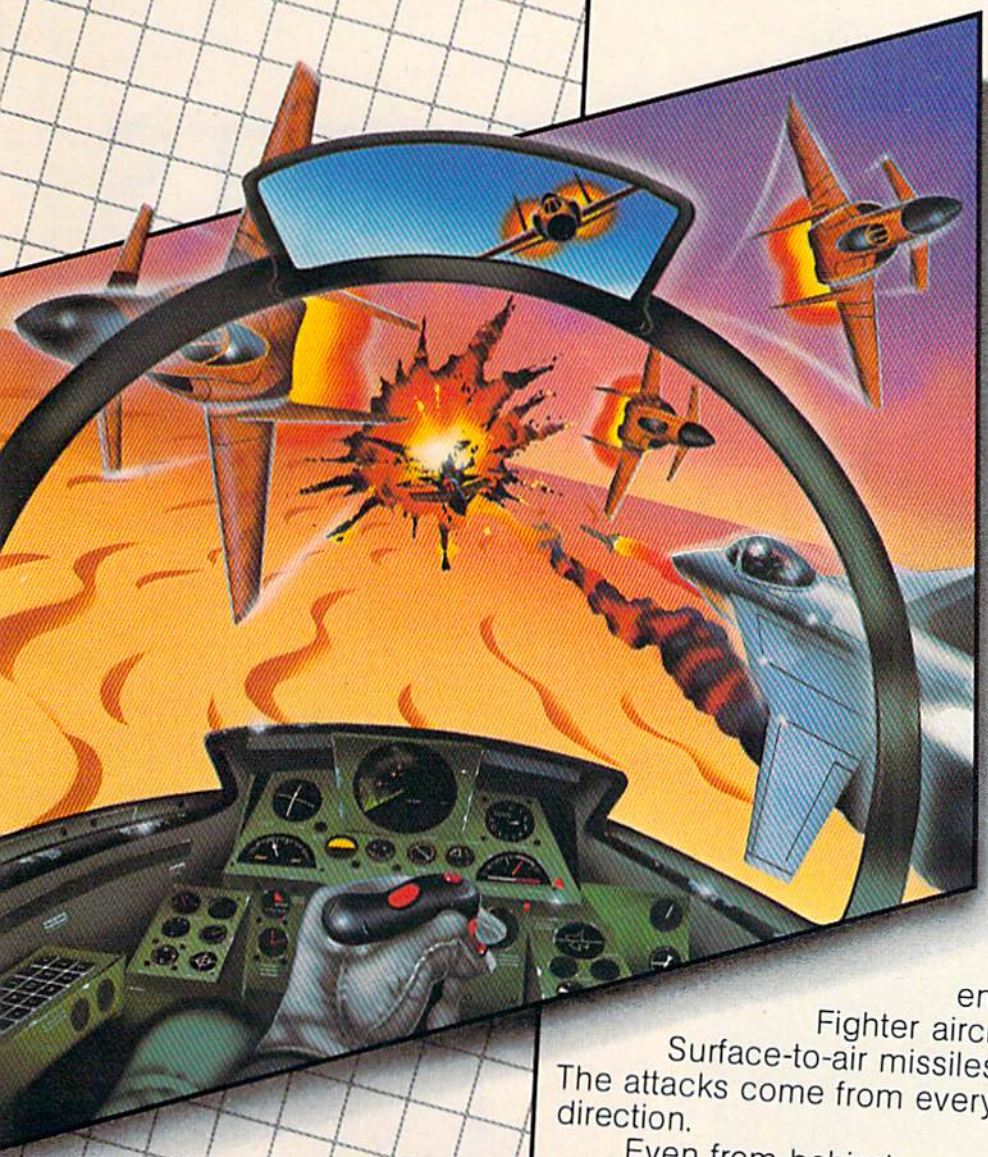
How can I merge two programs to use as a single program on my Commodore 64?

Khodadad Naimi

A program which will truly merge *two other programs must be quite sophisticated. It must collect all the lines from both programs in the proper order. It must also decide what to do if it finds the same line number in both programs. For an example of how this can be done with a VIC or 64 and disk drive, see the article on page 144 of the October 1983 issue of* COMPUTE!, *the* GAZETTE*'s sister magazine.*

If you simply want to tack the lines from one program onto the end of another program (called appending), that's a considerably simpler process. The following short program, from COMPUTE!'s First Book of VIC, *will append programs, providing the*

Dead end.



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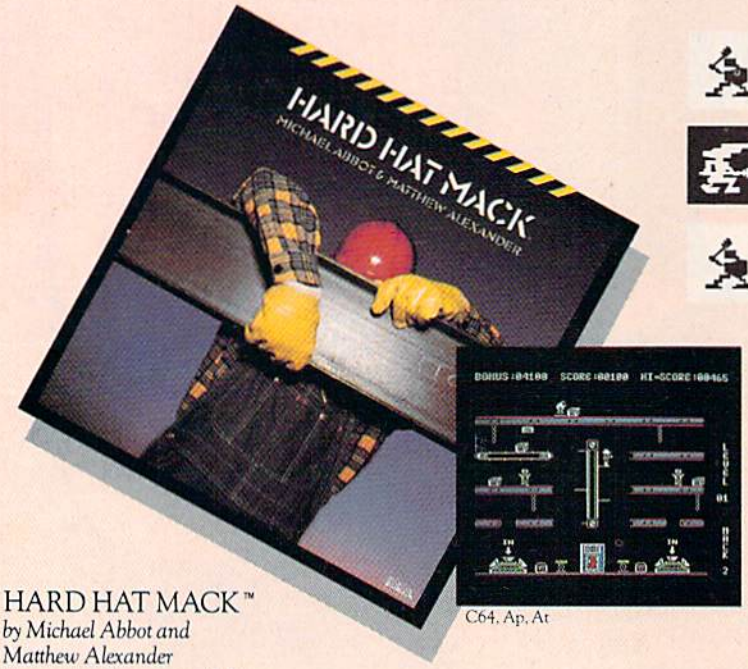

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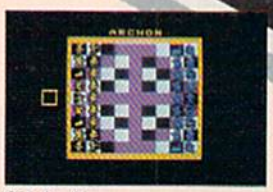

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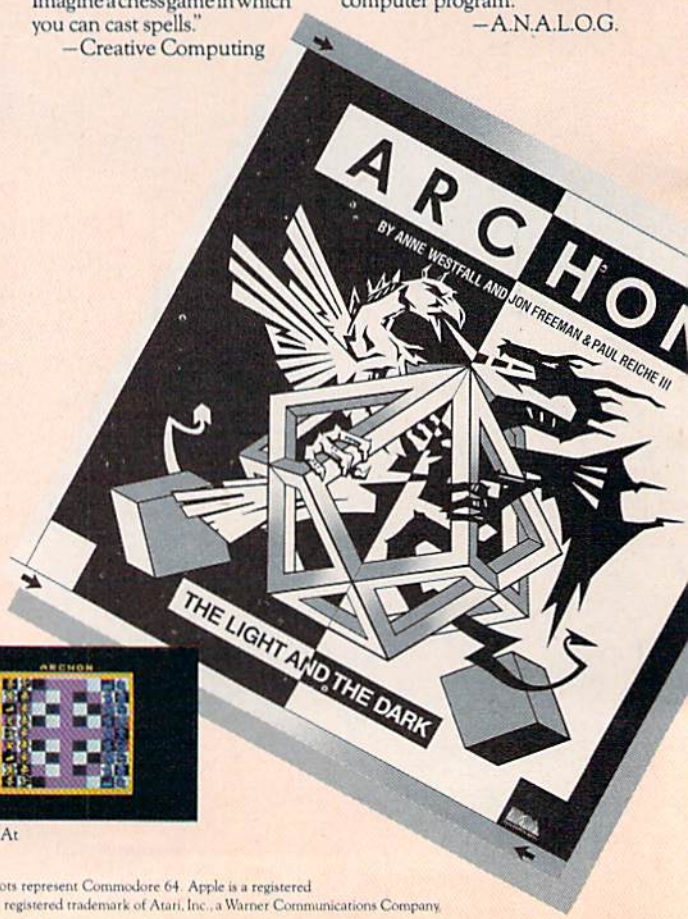

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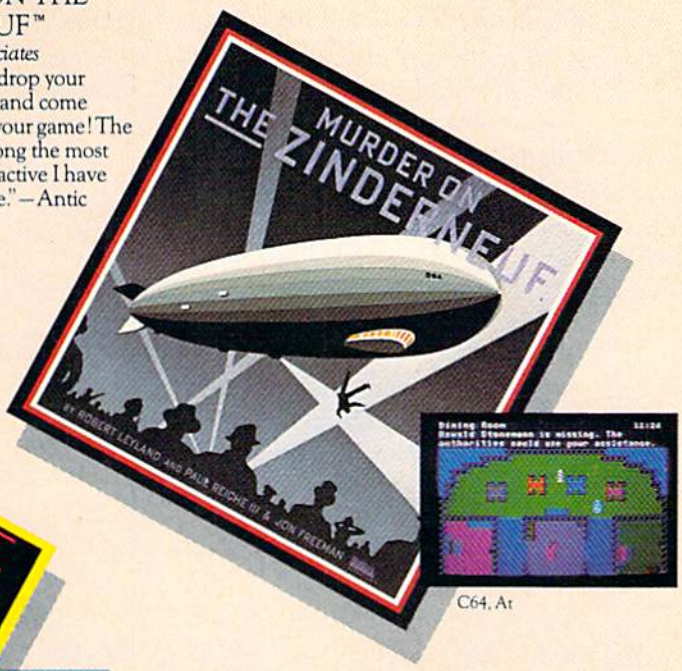

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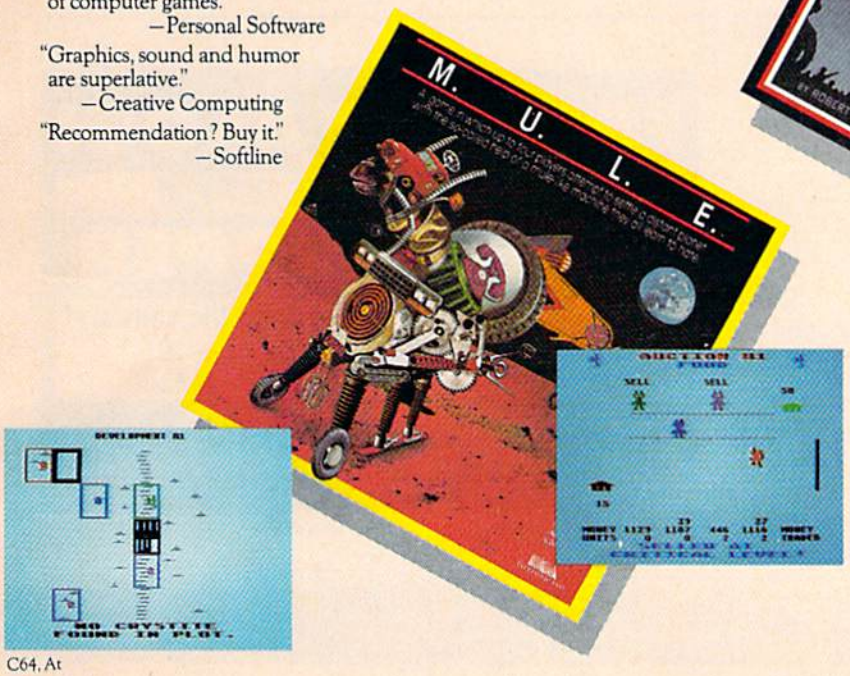

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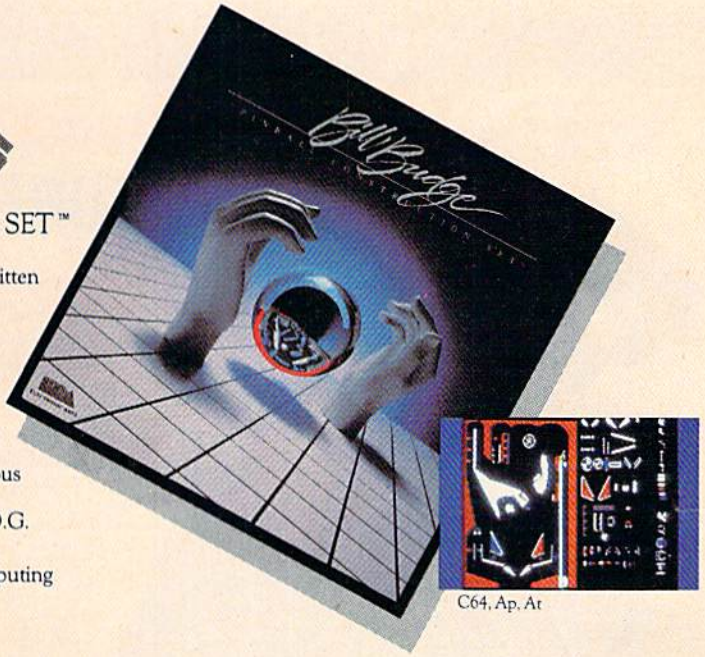

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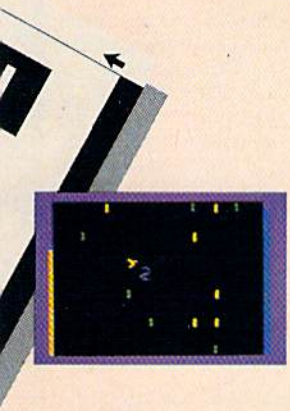

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following restrictions are met:

- *None of the programs may use line numbers 1–5.*
- *All lines in the program to be appended must have line numbers which are higher than the highest line number of the program in memory.*

```
1 A=PEEK(44)
2 PRINT"{CLR}{3 DOWN}LOAD{10 DOWN}
  {4 LEFT}POKE43,1:POKE44,";A;"{HOME}"
3 FOR I=631TO636:POKE I,13:NEXT:POKE 198,
  6
4 IF PEEK(45)<2 THEN POKE 43,PEEK(45)-2+2
  55:POKE 44,PEEK(46)-1:END
5 POKE 43,PEEK(45)-2:POKE 44,PEEK(46):END
```

This program will work on both the VIC and 64 if you are using a Datassette. If you have a disk drive, make the following changes:

```
1 A=PEEK(44):Q$=CHR$(34):R$=CHR$(141)
2 PRINT"{CLR}{3 DOWN}LOAD";Q$;"PROG1";Q$;
  ",8";R$;"{8 DOWN}POKE43,1:POKE44,";A;"
  {HOME}"
```

To use this program, type it in and SAVE it. When you want to append programs, first LOAD this program. Tape users should next insert the tape containing the first program to be LOADed and type RUN. Then insert the tape containing the first program to be appended and RUN again. Continue until all programs have been appended, then delete lines 1–5. Disk users should change the program name in line 2 to that of the first program to be LOADed, then RUN. Next, change the program name in line 2 to that of the first program to be appended and RUN again. Repeat until all programs have been appended, then delete lines 1–5.

The program works by changing the address for the beginning of BASIC to the address of the end of the program currently in memory (minus two bytes). The program then uses the dynamic keyboard technique to fool the computer into thinking that you typed in the LOAD and POKEs in line 2. These bring in the new program, then restore the address for the start of BASIC to its original value.

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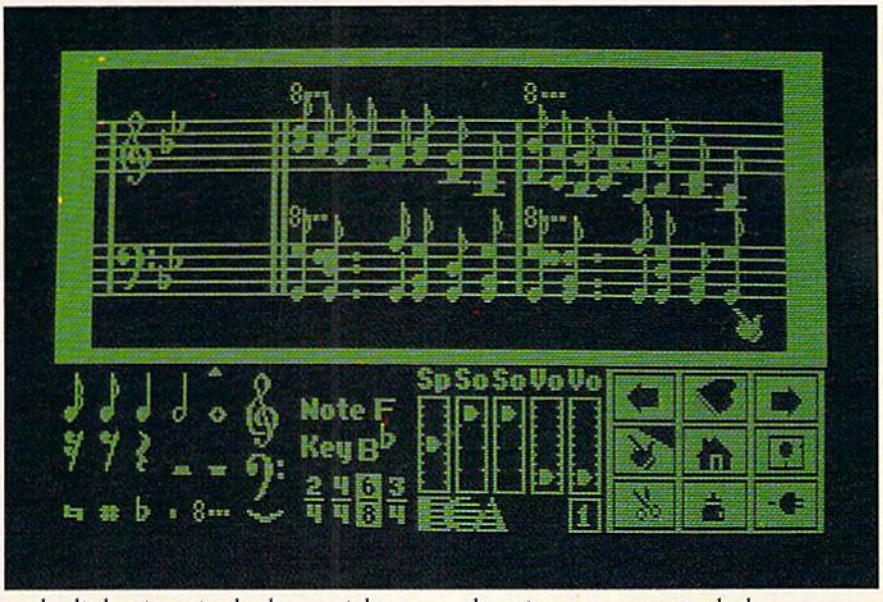

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Move those little scales in the middle up and down to vary the music's speed, sound quality, and volume. Use the scissors to cut out whole measures, then use the glue pot to paste them in somewhere else. Got a printer? Great. Print the score out and show it off to your friends.

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SIMPLE ANSWERS TO COMMON QUESTIONS

TOM R. HALFHILL, EDITOR

Q A

Each month, COMPUTE!'s GAZETTE *will tackle some questions commonly asked by new VIC-20/Commodore 64 users and by people shopping for their first home computer.*

Q. I've seen advertisements for "printer buffers" and have read many references to "cassette buffers," "keyboard buffers," "input/output buffers," and so on. Exactly what is a buffer?

A. Generally speaking, a buffer is a reserved area of memory which holds information until it is ready to be processed.

Buffers are most often employed in situations where the computer is too fast for its peripheral devices (such as printers, disk drives, tape drives, etc.). The speed disparity between computers and their peripherals has shackled computers ever since they were invented. The problem is that computers, electronic devices which operate almost at the speed of light, can easily outrun mechanical devices. No machine which depends on pulleys, rollers, gears, levers, and electric motors can keep up with a computer.

Let's look at printers, for example. A typical home computer hooked up to a printer is capable of sending many thousands of characters per second to the printer. But not many home computer printers can print more than 100 or 200 characters per second. Like a harried factory worker stationed on a lightning-fast assembly line, the printer can't keep up. If nothing were done to remedy the situation, maybe one of every ten or 100 characters would be printed. The rest would be lost in the shuffle.

One solution, in effect, is to slow down the computer so it doesn't send characters faster than the printer can take them. Although this restores the balance, it also drastically reduces the computer system's efficiency. When printing out a long program listing or text file, you have to wait until the printer is finished before the computer is available for another task.

A better solution is to set aside (or add) some memory for a buffer. Let's say we reserve 8K—enough to hold 8000 characters. Now, whenever we want to print a file, the computer sends the characters to the buffer at top speed until the buffer is filled. The buffer then sends the characters to the printer at whatever speed the printer can handle. As long as the file we're printing is not larger than the buffer, the computer is freed for other work while the buffer and printer chug away at their own pace. The computer's time (and your time) is not wasted.

Printer buffers are a commonly available accessory for most computers. (Some printers have built-in buffers.) But buffers aren't always outboard accessories. Computers, by necessity, have several internal buffers. One is the keyboard buffer. This is a very small buffer (usually one to ten bytes) which holds characters typed on the keyboard. To keep very fast touch-typists from outrunning the keyboard, the keyboard buffer stores keystrokes and then passes them along to the computer for processing. (On the VIC-20 and Commodore 64, the keyboard buffer is normally ten bytes long and is found at memory addresses 631 to 640.)

Similarly, a cassette buffer temporarily stores data on its way to or from the tape drive. There are also buffers for disk drive input/output.

Sometimes programmers—especially machine language programmers—take advantage of buffer memory space for their own purposes. On Commodore computers, for instance, the cassette buffer is a popular place to store short machine language routines. If the program is not using cassette input/output, the cassette buffer is idle and is a reasonably safe place to hide the machine language. The cassette buffer on the VIC and 64 is 192 bytes long, found at memory addresses 828 to 1019.

Q. What do the terms "coldstart" and "warmstart" mean?

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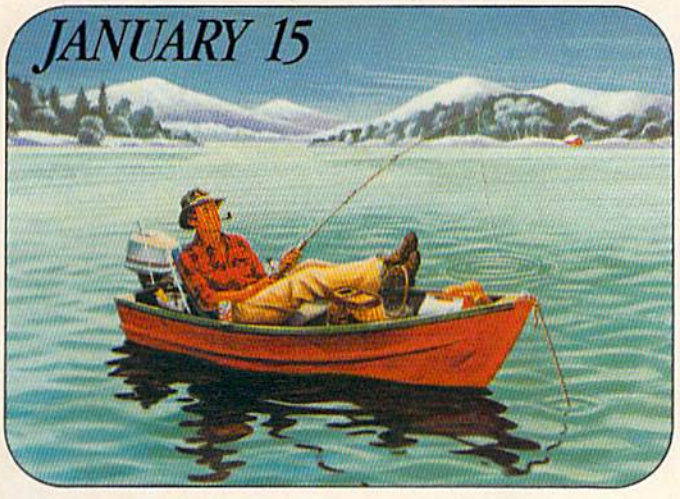

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The Creative Music System

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Put the MusiCalc™ diskette into your Commodore 64. Sit down. And brace yourself.

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MusiCalc software turns your Commodore 64 computer with disk drive into a sophisticated musical instrument. And it turns you into a composer, performer and conductor.

MusiCalc 1's Synthesizer & Sequencer is the heart of the system. With it you can use your computer keyboard to program the tempo, key and style of music you want, and also to play your favorite tune. The computer screen will show you what the music's doing as you play and how to control it.

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MUSICALC 1, Synthesizer & Sequencer Turns the Commodore 64 into a sophisticated musical instrument—a three-voice synthesizer and fully-interactive step sequencer. Play along with a song or write your own. Develop your own instrument sounds. And record the music you create.

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MAKING MUSIC PLAY

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STATE _____
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CG1

A. They refer to two different ways of resetting a computer. Resets are generally necessary for programmers; sometimes a programming mistake (particularly in machine language) "locks up" the computer. That is, the computer no longer responds to commands typed on the keyboard. It just sits there as if paralyzed. At other times, a programming error scrambles a program or its data so hopelessly that the only way out is to reset the whole computer.

A coldstart is the most drastic type of reset. The ultimate coldstart is to switch off the computer's power and then switch it on again ("start it cold"). Of course, since Random Access Memory (RAM) requires constant power to hold its information, this kind of coldstart completely wipes out the program and all its data—perhaps irretrievably, if a copy was not saved on tape or disk.

Sometimes a less drastic type of coldstart is possible. For example, if you enter SYS 64802 on the VIC or SYS 64738 on the 64, the computer seems to perform a power-off/on reset. Default screen colors and internal pointers are restored, the initial power-up screen appears, and any BASIC program present before the reset seems to be gone. However, the program is still in memory and can be recovered with a utility such as "VIC/64 Program Lifesaver" (COMPUTE!'s GAZETTE, November 1983). Another way to simulate a coldstart is to short together certain pins on the VIC or 64 user port (see "Horizons: 64," December 1983). Some plug-in memory expanders and motherboards use a similar technique to add a real reset button.

A warmstart is a less destructive type of reset. It resets the computer without erasing valuable programs or data. To prevent accidental resets, the VIC and 64 require a two-keystroke sequence: hold down RUN/STOP and slap RESTORE (merely pressing RESTORE doesn't work; it takes a somewhat sharp—but not savage—slap). This clears the screen, restores original colors and some internal pointers, and preserves your program.

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You guide him from cylinder to cylinder, changing the color on top of each. Change the top of each cylinder on a screen, then you're on to the next.

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Press the fire button! Jump two cylinders to safety. Hop into a transport tube, and then whoosh! Pogo Joe appears across the screen. Jump on an escaping monster. Blam! It's gone in a flash! Only to reappear out of thin air.

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"Bits And Bytes"

PBS's New Computer Series

Kathy Yakal, Editorial Assistant

Once you get started with personal computers, there are many ways you can learn about them. Schools offer computer literacy courses. Books and magazines publish information. User groups offer first-hand help with fellow hobbyists. Now television is starting to show some interest in computer education. Here's a look at a Public Broadcasting System show that is receiving a very favorable response: "Bits and Bytes."

Frances Seidenberg wanted to learn about computers. Knowing how to use one, she thought, would be helpful in her job as a freelance editor for a Toronto publishing company. She did have access to personal computers at work, and was learning a lot by editing books on educational software, but she felt that more personalized instruction was necessary. So she and her husband enrolled in "Bits and Bytes," a 12-week introduction to microcomputers that was being offered through TV Ontario, a public television station.

"It was absolutely perfect," says Seidenberg. "There was something in every program that I found useful."

"Bits and Bytes," just completing its second run on Canadian stations, is scheduled to be introduced to U.S. audiences in January 1984, under a different name: "Academy On Computers." The original course material, written by Jim Butterfield, has been substantially updated for its U.S. debut.

Initially, the show will originate from ten stations: KCET (Los Angeles); KPBS (San Diego); the Kentucky Educational Network; the Nebraska Educational Television Network; WNED (Buffalo); WNET (New York City); WXXI (Rochester, New York); WMHT (Schenectady, New York); WGTE (Toledo, Ohio); and WHA-TV (Madison, Wisconsin). A second run is already being planned beginning in mid-April, with several more stations participating. (Interested readers should contact their local PBS stations for more information.)

Of course, anyone within range of these PBS stations can watch the show for free. But those who sign up for the course and pay the registration fee of about $70 (this figure may be set by individual stations) will receive special courseware. The courseware includes text written to accompany the show, individual advice and instruction via periodic quizzes and evaluation sheets, a newsletter, and access to a special hotline staffed by local computer experts.

The creators of "Academy On Computers" say they designed the series for people who are interested in computers but who are bewildered by high-tech jargon, fuzzy computer manuals,

"PURE MAGIC FROM
THE MOMENT I PLUGGED IT IN."

"...I BUY YOUR SOFTWARE
JUST BY YOUR NAME."

"A PERFECT '10'!"

"...MY HUSBAND
WON'T COME TO DINNER."

"I NAMED MY DOG SHAMUS..."

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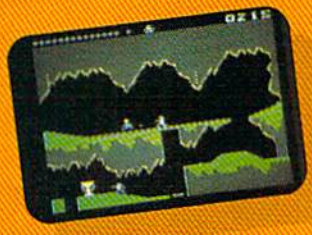

Ancient treasure
A fortune is yours for the taking. But can you avoid the ghost of Rama and the evil mummy? Are you nimble enough to leap the chasms and outsmart the booby traps between you and freedom? **The PHARAOH'S CURSE.***

Spellbinding
Only you can restore the forest through ancient spells. Then you must march your army of enchanted trees into battle against the Troglodytes and the evil Necromancer. Who will emerge triumphant from the final conflict? **NECROMANCER.***

Take the controls
Your helicopter mission—capture vital fuel and weapons, free the enslaved masses, and finally destroy the fortress itself. Will you triumph or be crushed by the fiendish Kraalthan lords? **FORT APOCALYPSE.***

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FOR YOUR C-64!

Awesome action
Maybe you've played pinball before, but not like this! No time to think, no room to make even one mistake. Just quick reflexes, light body armor and a whole lot of luck between you and the end of the game.
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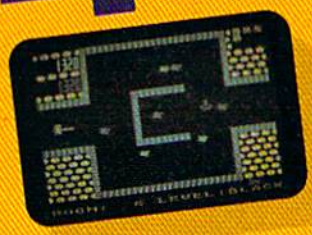
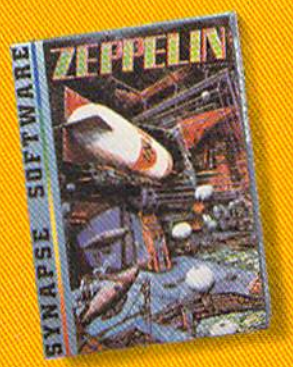
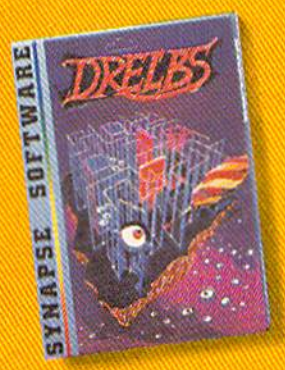
Very hot air
First the prison break, but that's only the beginning! The underground world of Zarkafir is full of surprises, from the lethal energy fields to devastating earthquakes. Can you defeat the Timelords?
ZEPPELIN.*

Flip-flop
Into this miniature land comes the evil Trollaboars, determined to take over. Their screwhead tanks will surely crush the peaceful Drelbs, unless you can defeat them on the atomic flip grid. **DRELBS.***



The Shadow knows
Deep in his lair the Shadow waits, protected by deadly Robo-Droids, Whirling Drones and Snap-Jumpers. Only the very strong and the very quick are ever seen again! **SHAMUS*** & **SHAMUS CASE II.***





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Hosts Luba Goy and Billy Van do the teaching and demonstrating in the television series "Bits and Bytes," one component of the ACADEMY ON COMPUTERS, a comprehensive educational package which provides computer training via television. The twelve-part television series premieres over ten public television stations the week of January 22, 1984.

and the flood of available hardware and software. During the course, viewers will be briefed on basic computer technology and will be introduced to sources of further information, such as software, books, magazines, and organizations. They will learn about the types of computer programs in use today, how to evaluate and select software, how to operate a personal computer, and even how to develop one or more simple computer programs.

"The handbooks and newsletters that accompanied the show were very helpful," says Frances Seidenberg. "But perhaps more important than that was the resources they pointed me to, like publications and user groups. I was able to visit computer stores while shopping for a micro and know what I was talking about."

The *Montreal Gazette* described the series as "the most intelligent, useful, and timely educational program on television today." Each half-hour show uses a variety of teaching techniques. Practice portions are interspersed with theory. There are explanations with computer and cell animation, interviews with experts, and visits to places such as Silicon Valley in California and a computer time-sharing service.

"Everything was very understandable," says Seidenberg. "When they came across a topic that was difficult to understand, they had little animated characters that simplified the explanation. It was informative without being too easy."

Canadian actors Luba Goy and Billy Van host the show. "She acted as the teacher, he the student," says Seidenberg. "He started out as the audience did, knowing nothing, and learned along with the audience. It was very effective."

Several factors make "Academy On Computers" unique. First, it allows viewers to set their own learning paces at home, unlike traditional TV courses which require enrollment through a local school. Second, it is a participative learning experience, thanks to the computer-managed evaluation system, consulting experts, and telephone hotline. Third, the show has the potential to reach the broadest audience of any computer instruction course ever taught: 13,000 people signed up for the first run in Canada, and many more are expected to enroll for the U.S. premiere.

It's not necessary to own a computer to benefit from the series. Seidenberg didn't have one. "We had planned to purchase an Apple IIe, but didn't get it until after the course was over," she says. "I think the course was still as effective."

George Rose, a Toronto resident who signed up for "Bits & Bytes," also didn't have a personal computer when he enrolled in the course. He still doesn't have one. "I think the course is very beneficial to someone who is interested in buying a computer," he says. "I'm still watching the marketplace and asking myself, 'What am I getting from my dollar?'."

Rose, the marketing director for a Toronto manufacturing company, says that years of working with business computers sparked his interest in home computers. Though he was very familiar with the workings of larger computers, he found "Bits and Bytes" a challenge. "The course material was very good, and the presentation was quite clear," he says. "But home computers are a lot different than the ones I was used to. I had to really think about the questions before I could come up with an answer."

The show does not focus on one specific brand of hardware or software, though the low end of the market is well represented by companies such as Radio Shack, Apple, and Commodore. Each program covers general information that applies to most computers, though specific models are used for demonstration purposes.

Here are examples of topics covered in some of the installments:

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First Star Has 4 New Games.

Fernando Herrera, the designer of *ASTRO CHASE* (1984 Science Fiction / Fantasy Computer Game of the Year*) and our design team again define "State of the Art."

Superior graphics, real-time animations™, multiple screens, intermissions, arcade-quality sound, innovative gaming, challenge and excitement—we deliver it all!

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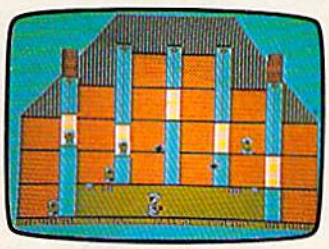
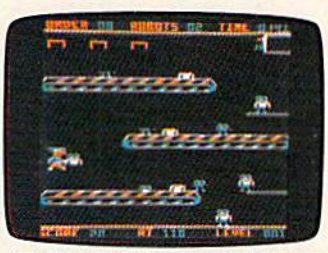


BRISTLES™
Starring Peter the Painter
Designed by Fernando Herrera
Atari Home Computers
Commodore by Adam Bellin

FLIP and FLOP™
Designed by Jim Nangano
Atari Home Computers
Commodore by Paul Kanevsky



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Program 1: Getting Started

- Explanation of basic computer terms: bits, bytes, chips, disks, CPU, etc.
- How to load disks and cassettes.
- A Hewlett-Packard representative takes a disk and disk drive apart and explains how they function.
- A discussion of artificial intelligence.

Program 3: How Programs Work

- An introduction to different computer languages.
- How to set up simple computer programs using GOTO and IF-THEN.
- An animated sequence explains the interaction between the CPU, RAM, and ROM, and what happens in the computer during input/output.
- A visit to Computertown USA in Menlo Park, California, a grassroots computer literacy organization.

Program 5: Communication Between Computers

- How modems work.
- How a personal computer can be linked through a modem to other micro-, mini-, and mainframe computers for sharing information.
- How to use a modem to contact bulletin boards systems (BBS) and data bases.
- A visit to The Source in McLean, Virginia, to show how an information service works.

Program 8: Simulations and Games

- Explanation of the concept of computer simulations, and how paddles and joysticks work.
- A survey of popular computer games.
- The difference between analog and digital.
- A visit with an Atari game designer who tells how simulations and games are being used in schools.

Program 10: "Computer Music"

- How to turn a computer keyboard into a musical keyboard.
- How to use music and voice synthesizers.
- A visit to Scarborough High School, the University of Toronto, and York University to show how music is taught with computers and synthesizers.

Program 11: Computers At Work

- How to use a word processor and other text-editing systems.
- How to use electronic spreadsheets such as *VisiCalc*.
- How printers and plotters work.
- A visit to an Ontario school which uses word processing in the classroom.

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METAMORPHOSIS

You stumbled into the nest of the Cyglorx and find yourself fighting off robot tanks guarding the Cyglorx eggs. You think you have everything under control and then the eggs start hatching. Commodore 64 version features 4 different screens.
Available for COMMODORE 64 and VIC-20. Played with JOYSTICK.

CREATOR'S REVENGE

The creator assembled a massive army of robots and insects to take revenge on the earth. Destroy insects, get treasures, and get the neutron bomb diactivator. Battle robots and destroy the neutron bomb before it annihilates your city. Miss and you must face the mutants. Features 4 different screens.
Available for COMMODORE 64. Played with JOYSTICK.

LABYRINTH OF THE CREATOR

Journey into the most complex and dangerous fortress ever build by the creator. You will encounter deadly robots, skulls, lakes, avalanches, false creators, and a creature who roams 256 rooms relentlessly pursuing you.
Available for COMMODORE 64. Played with JOYSTICK.

Programs for the VIC-20 and the COMMODORE 64
All games available on TAPE or DISK and are packed full of MACHINE CODE.

BOUNTY HUNTER

An adventure in the Old West. Journey back with us into the days of Jessie James and Billy the Kid where the only form of justice was a loaded revolver and a hangman's noose. In this full-length text adventure, you play the role of Bounty Hunter, battling against ruthless outlaws, hostile Indians, wild animals and the elements of the wilderness with only your wits and your six gun. Average solving time: 20-30 hours. If you love adventures, this one is a real treat.
Available for COMMODORE 64 or the VIC-20 (with 8K or 16K expander). Played with KEYBOARD.

KONGO KONG

Climb ladders, avoid the barrels the crazy ape is rolling at you, and rescue the damsel. Commodore 64 version features 4 different screens!
Available for COMMODORE 64. Played with JOYSTICK or KEYBOARD.

CAVE KOOKS

Earth's surface is threatened by collapse from a strange group of creatures who bore out the earth's crust to make their dens. Your objective is to enter the creature's habitat and spin the invaders to death.
Available for COMMODORE 64. Played with JOYSTICK.

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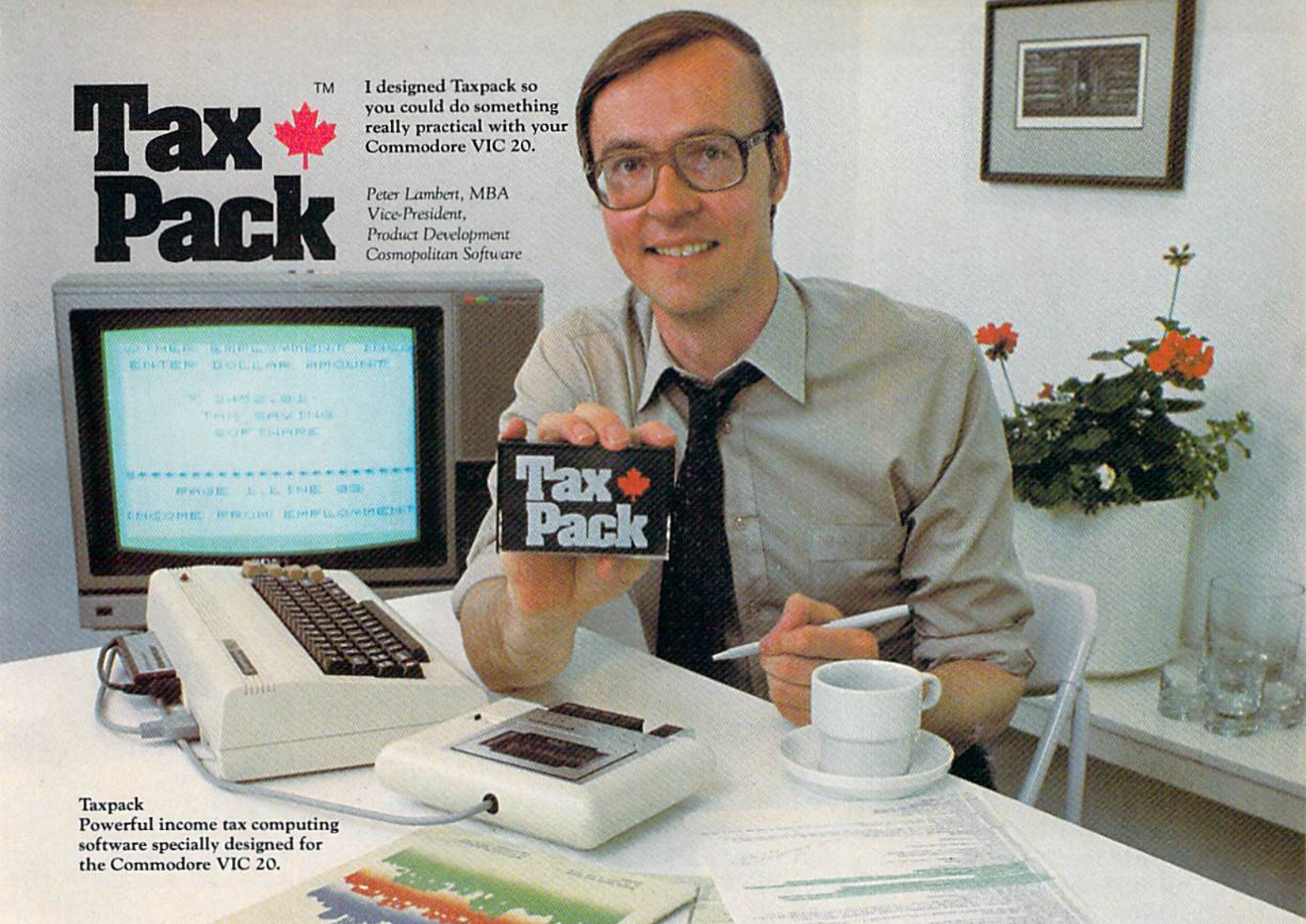

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The Inner World Of Computers

Part 4: The Inside Story

Tom Prendergast

In the first three installments, we discovered the on-off switches in the computer, as well as how to control logic and store information by turning switches on or off. This month's installment explains binary arithmetic—the numbering system your computer understands.

When Snow White's seven dwarfs went whistling off to work, it wasn't to do computing—because seven's not a power of two. But if she'd been a liberated woman and gone to work with them, it would've made eight. Eight is a power of two, and the powers of two are what give computers their computing power.

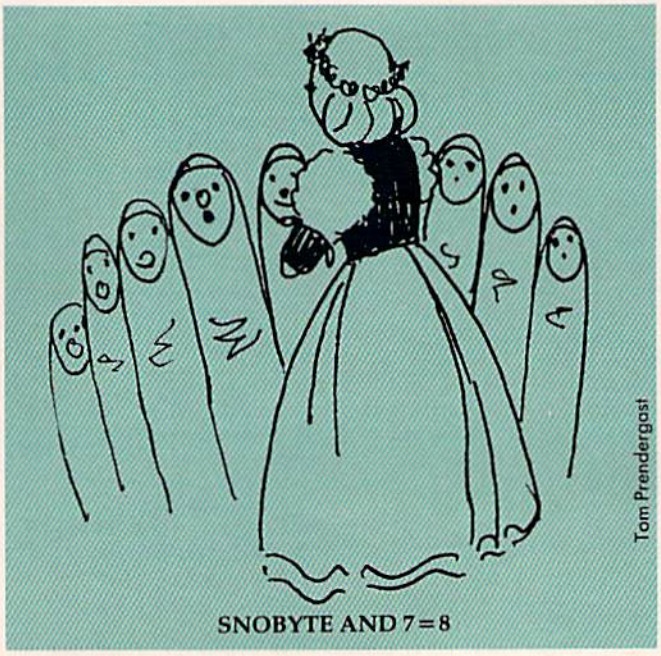
Decimal (base 10) has been our way of writing and thinking about numbers for thousands of years, and as long as humans have ten fingers and toes, we'll be using decimal for thousands of years more.

Computers, though, are binary. Everything you type into a computer ends up turning tiny microswitches ON or OFF: binary.

It doesn't make any difference whether you think of binary as sequences of 1's and 0's, as heads or tails, as hot or cold, even/odd, yes/no—the computer doesn't know, or care. So if computers think—and you can get into a big argument on this—they think in binary terms: on/off, yes/no.

But people don't think in binary. It's always "yes, maybe," or "no, but...." That's OK, though. Who wants a computer that gives you a lot of ifs and maybes when all you want is a simple answer?

The powers of two, if you remember from our previous articles, are multiples of two: 1, 2, 4, 8, 16, 32, 64, 128...and so on to infinity, which is one of those mythical places like ELFdom that you can never quite get to.



SNOBYTE AND 7 = 8

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Here are the powers of a byte in "exponential notation":

$2^7\ 2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0$

The little, raised numbers (the *exponents*) tell you how many times the base (in this case, 2) is multiplied to give you the power of that position. Starting from the right, 2^0 is two multiplied zero times (in other words, it's not multiplied at all). Next is 2^1, "two to the first power": two multiplied once, or 2*1. 2^2 is two multiplied twice, 2*2, two squared; and 2^3 is 2*2*2, and so on. Home computers, though, don't have the little exponent numbers, so you have to use the up-arrow (↑) key above RETURN on the VIC and 64 keyboard.

If you want to find out what 2 to any power is, ask your trusty VIC or 64. (I always use a question mark—the abbreviation for PRINT—when I'm asking my computer a question.) Try this:

```
?2↑7
```

Did you get 128 for an answer? Now, try 2^0:

```
?2↑0
```

Surprised? You'd think that the zero power would be a 0, wouldn't you? The zero power of any base—binary, trinary, quartal, octal, decimal, hexadecimal—is always one, or "unity." Try the zero power in decimal (base 10):

```
?10↑0
```

Still got a 1, right? Now ask for 10 to the first power:

```
?10↑1
```

Did you get 10? Switch over to hex (base 16):

```
?16↑1
```

You should get 16. Switch back to binary (base 2):

```
?2↑1
```

and you get 2! The first power of any base is always the base itself—2 for binary, 8 for octal, 10 for decimal, 16 for hexadecimal, and so on.

Hexadecimal is a very close relation of binary. You might even call her Auntie Hex, because 16 is a power of two (2^4), and as we know from previous articles in this series, hex is shorthand for binary. That is, every four-bit segment of binary (a *nybble*) can be directly translated into hex:

Hex: $	**9**	**0**	**0**	**F**
Binary:	**1001**	**0000**	**0000**	**1111**

It also works the other way around, as you can see in the above example: Every hex digit can be directly translated into four binary digits.

This can get a little confusing, so let's look at a program that illustrates the similarities and the differences between binary and hex:

```
10 POKE=0                              :rem 91
20 PRINT" 2↑"PO"="  2↑POKE              :rem 0
30 PRINT"16↑"PO"="16↑POKE              :rem 107
40 POKE=POKE+1                         :rem 23
50 GET G$:IF G$=""THEN 50              :rem 249
60 PRINT:IF POKE<=4 THEN 20            :rem 135
```

When you type RUN and RETURN, the zero power of 2 (binary) and 16 (hex) both appear. Press the space bar, or any key, to get the next power of 2 and 16. If you want to go off into never-never land—close to infinity—or at least until you get an ?ILLEGAL QUANTITY ERROR, change line 60 to:

```
60 PRINT:GOTO 20
```

Neither hex nor binary, though, can be directly translated into or from decimal. How do you figure out the decimal?

It's tough enough figuring out the binary for nybbles and bytes, but what about those really big numbers?

Now for the good news: You need binary only for manipulating DATA—when you're ANDing and ORing and doing those other fancy tricks we touched on earlier in our series. And since DATA is never bigger than a byte, that means you'll never have to know binary beyond 255 (11111111).

This is because the VIC and 64 (and Apples and Ataris) are 8-bit computers, and 11111111—a full byte—is the limit of "on" bits you can pack or POKE into a memory cell. Each memory cell is also known as a *memory location* or a *memory address*—a place where a byte is stored.

Oftentimes, though, the computer needs to deal with numbers bigger than a byte—greater than 255.

But how do you pack 16 bits into 8 bits in an 8-bit computer? You don't. The computer hitches two bytes together to form a two-byte address. With 16 bits to play with, you can have an address as high as 65535 (1111111111111111 in binary). There's a "zero" address, too, but since addresses are always two bytes long, its binary form is all zeros: 0000000000000000 ($0000 in hex).

Of course, the computer uses binary for addresses, too, but when you're programming in BASIC, your computer handles that automatically.

Suppose, though, that you're looking at a memory map showing where certain color or sound operations are located, and you'd like to POKE different values into these locations (addresses). Sometimes the addresses are given only in hex.

You could rush out and buy one of those calculators that translate decimal to hex, or hex to decimal, even octal. They cost $20 to $100. Another way is to multiply each hex digit by its hexadecimal

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STRATEGY GAMES FOR THE ACTION-GAME PLAYER.

*Game Manufacturers Association, 1981

power, add them all together, and—if you haven't made any mistakes—you've got your decimal. Gulp!

If you're going to do many of these conversions, or if you're as bad at figures as I am, it'll be worth your while to type in the utility programs which let you input any hex or decimal number and get the conversion. (See Programs 2 and 3 at the end of the article.) They're not as much fun as "Binary Castle" a few months ago, but based on the same idea.

The Commodore 64 has 65536 byte-sized memory cells—0 to 65535—which you can address. Approximately 27,000 of these are ROM (Read Only Memory). You can address any memory cell, RAM (Random Access Memory) or ROM, or PEEK to find out what value is stored there, but you can only POKE a new value into a RAM cell. The big difference—and it's huge—between the 64 and the VIC is the amount of RAM memory cells. You can still address 65536 memory cells on a VIC, but that doesn't mean there's anyone at that address to receive it: it's like mailing a letter to a vacant lot.

Think of your computer as a giant warehouse—shrunk down to ELF size—where they store *Whatsits*. Whatsits have all sorts of uses, some that haven't even been thought of yet—which is why they're called Whatsits. Like automobiles, Whatsits come in all shapes and sizes, but, unlike automobiles, they never wear out. Another thing, if you don't like the way they run, you can take them apart and reassemble them because all the parts of a Whatsit are interchangeable—like programs. In fact, Whatsits are program bytes.

Now imagine an army of ELFS grabbing the Whatsits off the conveyer belt (as you type in your program), climbing up ladders, and storing the Whatsits on the shelves so they'll be ready when the program is run.

The Whatsits for PRINT and GOTO and other operations go on the bottom shelves where they'll be handiest, and those for the variables and strings are stored up top.

This is OK if you have enough shelves. But if you have only a few thousand shelves, like an unexpanded VIC, the variables and strings begin to fall down from the top and meet the program parts coming up. What do you do then? You just can't pile the new parts coming in all over the place. How would you ever find them when the program needed them? So the ELF in charge of storing things blows the panic whistle and ? OUT OF MEMORY ERROR flashes on your screen. No more storage space, no program.

There's another thing that can go wrong, too. (Isn't there always?) Even if you have enough storage space, the data bytes have to be in the right place (address) on the shelves. As the ELFS say: "Without the right address, a byte is a blyte."

For instance, if you want to turn the VIC screen black with white letters at a certain point in your program, the data byte "8" has to be in address 36879 when the program calls for it.

But let's say your program is just the right size for the amount of memory. You might even have a few empty shelves for data bytes created later on in the program. Things are running as smooth as silk and all you can hear are little clicks of ELF talk (ELFin) as your program starts its run. But ELFin has a lot of uses aside from running the system inside the computer. There's a technique called "bit indexing," which I plan to have ready for demonstration next month. This allows for quick and easy handling of thousands of data items, without using thousands and thousands of bytes of memory. This means you can run a huge "professional" data bank system on an unexpanded VIC!

In the meantime, if you have trouble figuring out binary above 1111 (15), use Program 5.

If you're like me, though, you've always got a program running when you need a quick conversion. If you don't have another computer to run one of the conversion programs at the end of the article, you'll have to do it the old-fashioned way, with pencil and paper.

Fear not, though. There's an easy, if somewhat slow, way of converting decimal to binary. The trick is to keep dividing by 2.

To start off, we jot down a 1 if the decimal number we're converting is an odd number, or a 0 if the decimal is even. Then we divide the number by two—ignoring any remainder—and put down a 1 if the result is odd, or a zero if it's even. We keep dividing each result by two until the division results in 1.

To convert 16 to binary, for instance, we start by putting down a zero because 16 is an even number:

```
16    0
```

Sixteen divided by two is eight—another even number—so we jot down another zero. Eight divided by two is four, still even and another zero. Two divided by two is one, an odd number, finally, and we jot down a one. We can't divide one, so we write our four zeros and the one down in a row starting from the right, and see that 16 is 10000 in binary. The complete operation should look like this:

```
16 (even) =          0
16½ = 8              0
8½ = 4               0
4½ = 2               0
2½ = 1               1
16 =                 10000
```

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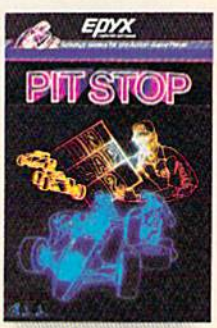

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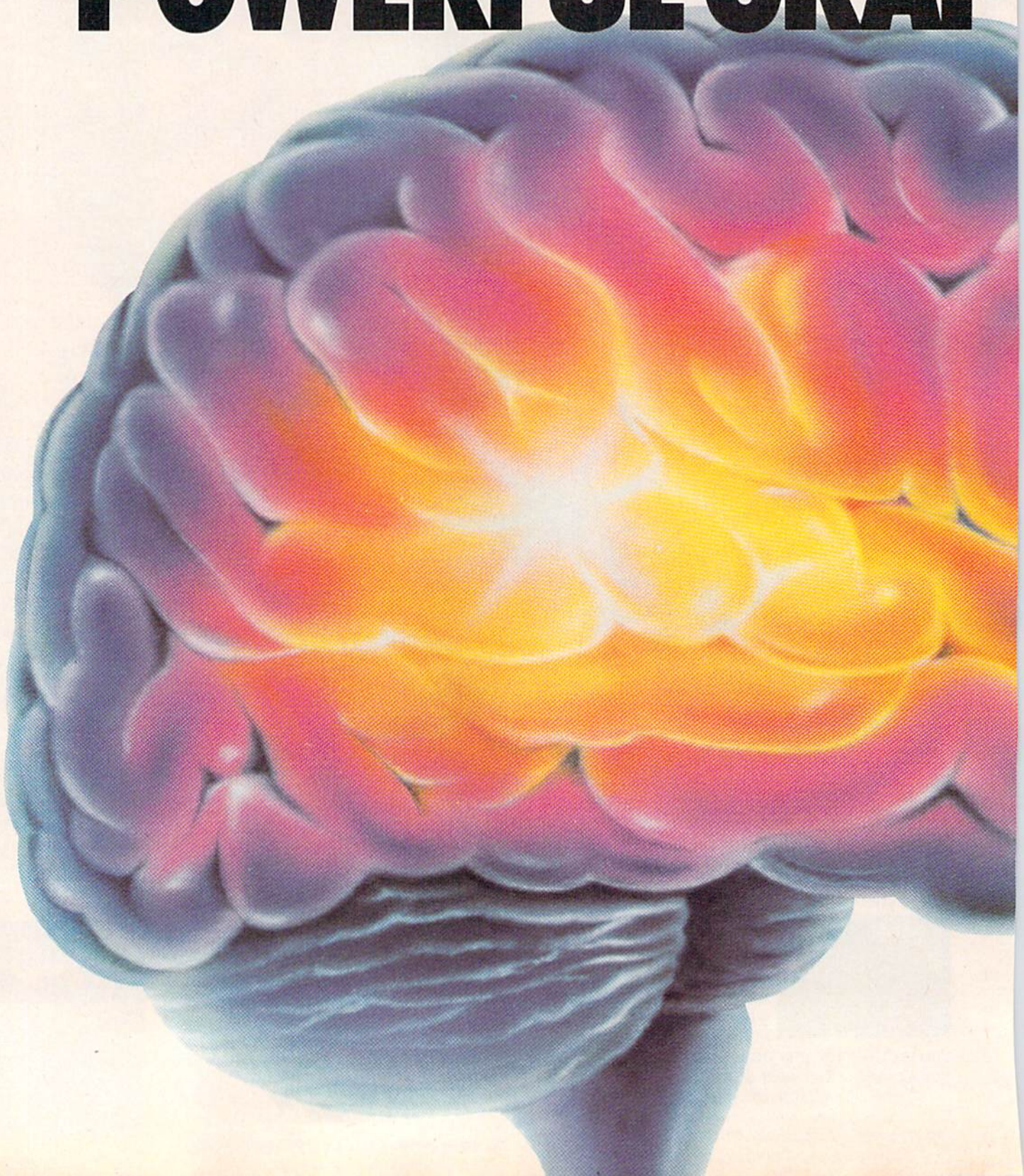

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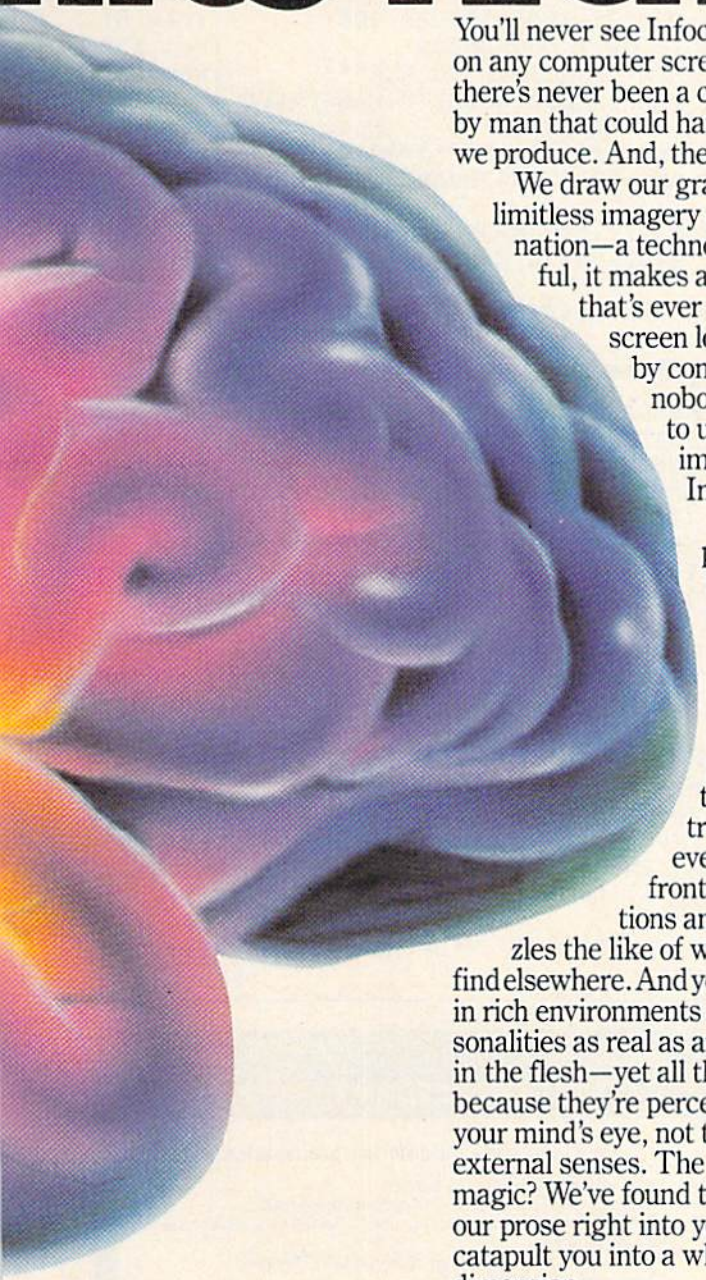

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We add three leading zeros to make the full byte of eight bits and get:

```
binary 16=00010000
hex 16=$1  0
```

You'll get to be an expert so fast you'll be able to do this in your head and not have to write anything down. And since you can convert each binary nybble to hex, it's a faster way of converting decimal to hex than dividing by a lot of 16s. More trustworthy, too.

Let's do another decimal-to-binary—with a number that's bigger and not a "power of two" like 16—so you'll get the hang of it. Let's convert 171 to binary. Since 171 is odd, we jot down a 1:

```
171  1
```

Dividing 171 by two gives us 85 (forgetting the remainder), and this is odd so we jot down another one. 85 divided by two is 42—an even number—so we jot down a zero. 42 divided by two is 21—odd—so we jot down a one; 21 divided by two is ten—even—so we jot down a zero; 10 divided by two is five—odd—so we jot down a one; five divided by two is two—even—so that's a zero; and two divided by two is one—odd—and that's a one.

We don't need leading zeros this time because we have a full byte, so our binary looks like this:

```
binary 171=10101011
hex 171=$A  B
```

Powers Of 2 And 16

```
5 REM POWERS OF 2 AND 16          :rem 250
9 PRINTCHR$(147);CHR$(18);"TOUCH SPACEBAR
  "                               :rem 237
10 PRINTCHR$(18);" TO CONTINUE{2 SPACES}"
   :POWER=0                       :rem 100
20 PRINT" 2 ↑"PO"="2↑PO            :rem 18
30 PRINT"16 ↑"PO"="16↑PO           :rem 125
40 PO=PO+1                         :rem 59
50 GET G$:IFG$=""THEN50            :rem 249
60 PRINT:IF PO<=4 THEN 20          :rem 153
70 PRINT" 65535 IS THE HIGHEST"    :rem 201
80 PRINT"{4 SPACES}ADDRESS ON THE"
                                   :rem 189
90 PRINT"{6 SPACES}VIC OR 64"      :rem 39
```

Hex To Decimal Conversion

```
10 REM HEX TO DECIMAL              :rem 188
20 PRINT:PRINT"HEX NUMBER:"        :rem 226
30 INPUT H$                        :rem 95
40 L=LEN(H$):XP=L-1:FORI=1TOL:DM$=MID$(H$
   ,I,1)                           :rem 210
50 IFDM$<="9"THEN DM$=STR$(VAL(MID$(H$,I,
   1)))                            :rem 239
60 IFDM$=>"A"THEN DM$=STR$(ASC(DM$)-55)
                                   :rem 173
70 D=D+(VAL(DM$))*16↑XP:XP=XP-1    :rem 77
80 NEXT:PRINT:PRINT"{3 SPACES}$"H$" ="D"D
   ECIMAL":PRINT:RUN               :rem 247
```

Hex To Decimal/Decimal To Hex

```
10 REM HEX TO DECIMAL              :rem 188
20 PRINT:PRINT"HEX NUMBER:"        :rem 226
30 INPUT H$                        :rem 95
40 L=LEN(H$):XP=L-1:FORI=1TOL:DM$=MID$(H$
   ,I,1)                           :rem 210
50 IFDM$<="9"THEN DM$=STR$(VAL(MID$(H$,I,
   1)))                            :rem 239
60 IFDM$=>"A"THEN DM$=STR$(ASC(DM$)-55)
                                   :rem 173
70 D=D+(VAL(DM$))*16↑XP:XP=XP-1    :rem 77
80 NEXT:PRINT:PRINT"{3 SPACES}$"H$" ="D"D
   ECIMAL":PRINT                   :rem 200
90 PRINTCHR$(18);"{2 SPACES}TYPE'D'FOR
   {2 SPACES}":PRINTCHR$(18)"DECIMAL TO H
   EX"                             :rem 40
100 GET G$:IFG$=""THEN 100         :rem 81
110 IF G$<>"D"THENRUN              :rem 178
111 REM***DECIMAL TO HEX***        :rem 234
112 REM*{2 SPACES}BY R.MANSFIELD
    {2 SPACES}*                    :rem 122
113 REM********************        :rem 193
120 HE$="0123456789ABCDEF":INPUTD:DE=D
                                   :rem 185
130 H$="":FOR M=3TO0STEP-1:N%=DE/(16↑M):D
    E=DE-N%*16↑M:H$=H$+MID$(HE$,N%+1,1)
                                   :rem 8
140 NEXT:PRINTD"= $"H$" HEX":RUN   :rem 72
```

Any Base To Decimal Conversion

```
10 REM ANY BASE TO DECIMAL         :rem 218
20 PRINT:INPUT"BASE ";B            :rem 149
30 INPUT"NUMBER";B$                :rem 161
40 L=LEN(B$):XP=L-1:FORI=1TOL:DM$=MID$(B$
   ,I,1)                           :rem 198
50 IFDM$<="9"THEN DM$=STR$(VAL(MID$(B$,I,
   1)))                            :rem 233
60 IFDM$=>"A"THEN DM$=STR$(ASC(DM$)-55)
                                   :rem 173
70 D=D+(VAL(DM$))*B↑XP:XP=XP-1     :rem 40
80 NEXT:PRINT:PRINT"{3 SPACES}"B$" ="D"DE
   CIMAL":PRINT:RUN                :rem 205
```

Binary To Decimal Conversion

```
10 REM BINARY TO DECIMAL           :rem 156
20 PRINT"{CLR}"                    :rem 198
30 INPUT"BINARY";B$                :rem 157
40 L=LEN(B$):XP=L-1:FORI=1TOL:DM$=MID$(B$
   ,I,1):D=D+(VAL(DM$))*2↑XP:XP=XP-1
                                   :rem 177
50 NEXT:PRINTB$" ="D:B$="":D=0:PRINT:GOT
   O30                             :rem 122
```


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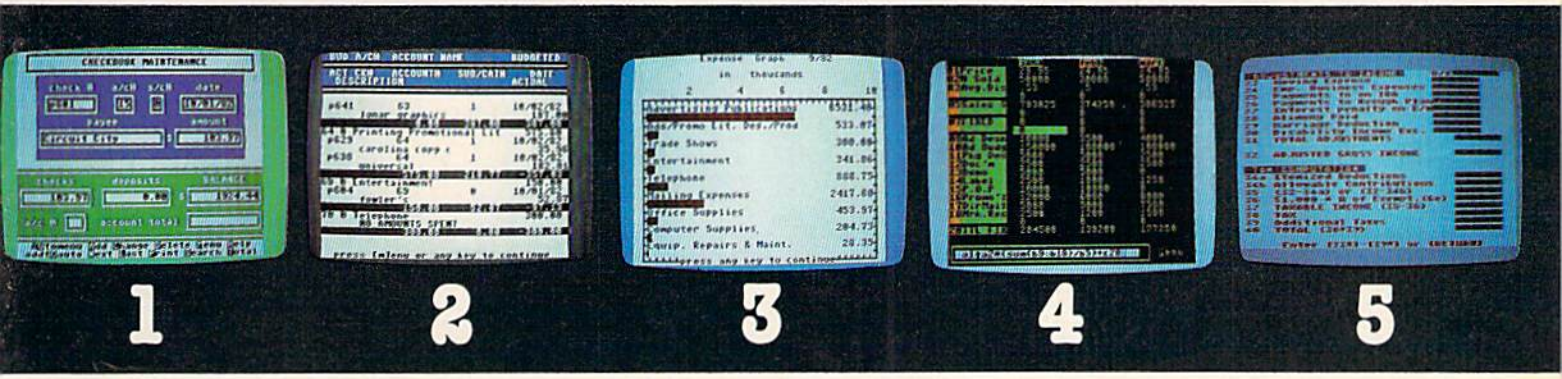

actual screen display *Indicates function being shown

Chart of Accounts
*Checkbook Maintenance
Check Search
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Summary Budget Analysis
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Getting Started With A Disk Drive

Part 4: Data Files

Charles Brannon, Program Editor

This month, we'll see how to use disk data files and look at some useful techniques when reading and writing to data files.

You save your programs because you know that Random Access Memory (RAM) is transient. Turn your machine off, and it forgets everything you taught it. This is because RAM (specifically, dynamic RAM) is a bunch of little capacitors that need to be constantly recharged (technically, refreshed) in order to hold their ones and zeros.

Incidentally, Read Only Memory (ROM) is made of tiny fuses that have been permanently blown (a rough analogy). Normally, a ROM chip would be full of ones (so electricity can flow), but holes (zeros, areas where current does not flow) are burned into it by selectively blowing the tiny fuses. ROMs are usually created with the fuses "preblown" on the chip. ROMs are used to store information which must not be forgotten, such as the operating system, the BASIC language, and your favorite game cartridge.

By now you understand how to save programs stored in RAM onto disks. But what about your variables, such as arrays, values, and strings? After someone goes to the trouble to enter his name, social security number, today's date, and a slew of other information, the program does its task, then ends. When you run the program again, the variables are cleared. Even if it didn't clear the variables, you might want to enter new data into the program. What if you wanted to reference the old data, though?

If the information could be saved like a program, a whole new world of information-processing opens up. You could search the data for patterns, compute tax, interest, or whatever you dream up. The data could be reused at a later date by another program. If you had some way to preserve your data, you could keep cumulative values such as year-to-date, accrued interest, high scores, etc.

One solution is to enter the information right into the program with DATA statements. It would then be saved with the program. These aren't truly variables, though, since your program can only read them, not change them. DATA statements can be thought of as read-only variables.

What we need is a way to save variables, as we do programs. Actually, all we really want to do is save the values of the variables. And we don't need to save all the variables, so we'd like to be selective. That way, another program can read the values into variables with different names.

Writing data files is fairly easy. You just OPEN a file for write, PRINT all the variables to the file, then CLOSE the file. You use PRINT because it sends out the value of a variable. If A=5 and X$="HELLO", then PRINT A will display 5 and PRINT X$ will display HELLO. That's what you want to do with the file. It should hold a list of all the values you want to save. That way, you can OPEN a file to read, INPUT the values into vari-

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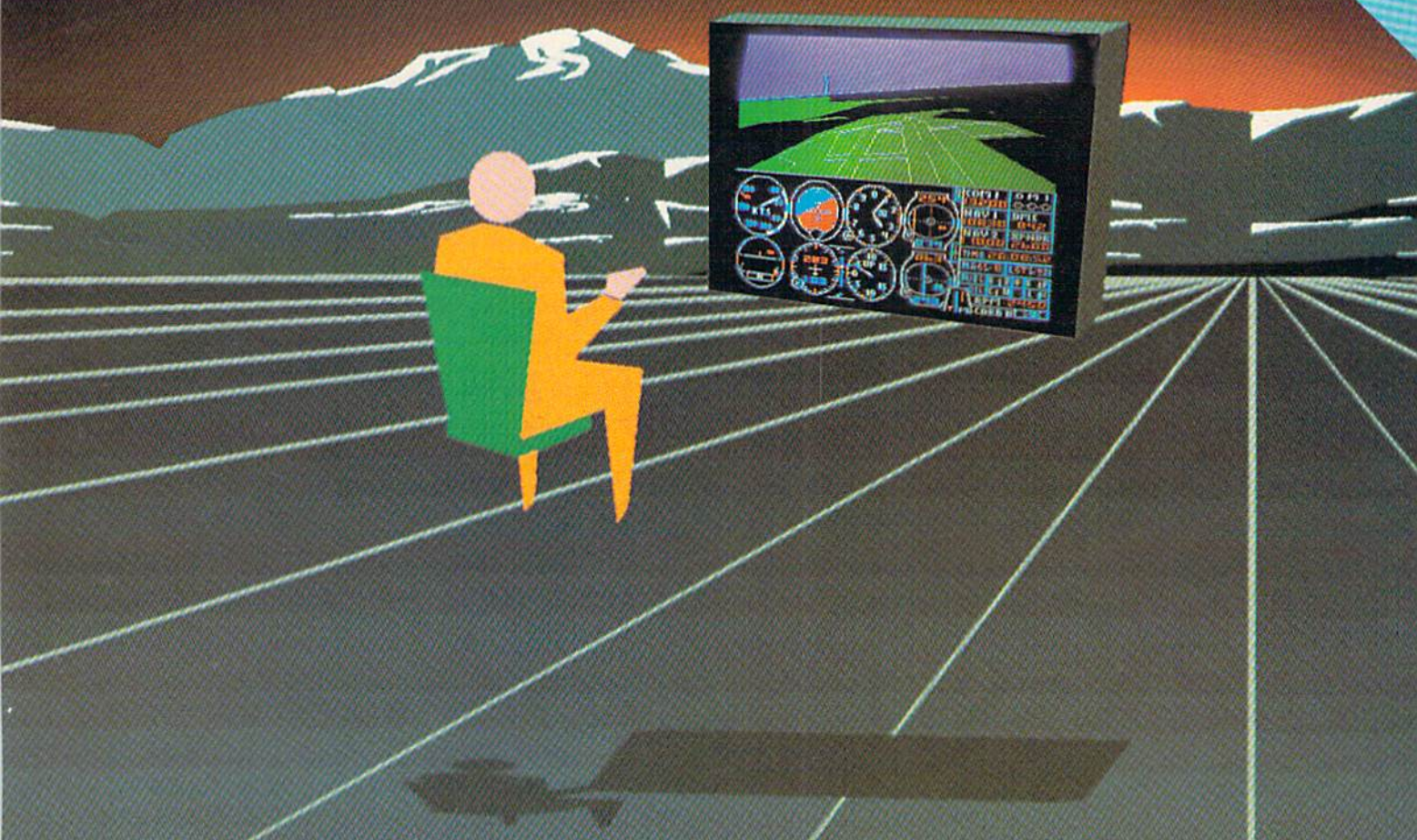

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ables, then CLOSE the file.

Data files just substitute the disk for the screen in PRINT, and the disk for the keyboard (you) in INPUT. If you keep this in mind, it will all make more sense.

Let's say you wrote a file out that just contained strings:

```
10 OPEN 1,8,8,"0:DATAFILE,S,W"
20 A$="HELLO":B$="GOODBYE":C$="ALOHA"
30 PRINT#1,A$,B$,C$
40 CLOSE 1
```

The biggest problem people seem to have with files is not writing them, but reading them correctly.

Don't worry about the details. Just look at line 30. You know what this would do if you PRINTed to the screen:

```
HELLO         GOODBYE         ALOHA
```

That's right, there would be spaces between the items, due to the commas between them. Now let's say you want to read them back in. You might code: INPUT A$,B$,C$. But would this work? If you manually typed in the three items separated by spaces, it would all go into A$, since you know that you have to end each entry with RETURN, or separate it with a comma. So we need to change line 30 to:

```
30 PRINT#1,A$+","+B$+","+C$
```

This will write the file like so:

```
HELLO,GOODBYE,ALOHA
```

just as you would type it in to an INPUT statement.

We could also separate it with RETURN by PRINTing the values on a separate line:

```
30 PRINT#1,A$:PRINT#1,B$:PRINT#1,C$
```

If PRINTed to the screen, we would get:

```
HELLO
GOODBYE
ALOHA
```

Keeping in mind that CHR$(13) is the same as a RETURN key, we could put it all together like this:

```
30 PRINT#1,A$+CHR$(13)+B$+CHR$(13)+C$
```

We don't end the last variable with a CHR$(13) because it is at the end of the line. Again, keep in mind how the variables would look on the screen. You have to write the data out so that INPUT can read it in properly.

Time for details. You OPEN a file to the disk drive as we did last month, but you give it a filename (like you do with SAVE and LOAD):

```
10 OPEN 1,8,8,"0:DATAFILE,S,W"
```

In the above statement, the 1 is just a number we'll use to refer to the file. The second number, 8, refers to the disk drive. It will always be 8 with the disk, unless you have another drive set up as device 9. The third number is also an 8, and this is somewhat arbitrary.

When you write or read data to or from a file, it isn't stored on the disk (during output) or sent to the computer (during input) until 256 characters have filled a disk buffer. The buffer is then sent to the computer, or written to a sector. This is because a disk sector is 256 bytes long, and you have to read or write a whole sector at a time.

There are 13 of these buffers available for your use, numbered 2–14. The number 15 is reserved for the command channel, and buffers 0 and 1 are used by BASIC for SAVE and LOAD. You can use any number for 2–14, but if you have more than one file open at one time, you have to use a different buffer number for each one.

Finally, we have the filename. It is a string, so it is enclosed in quotes. You could also do something like:

```
10 INPUT "FILENAME";F$
20 OPEN 1,8,8,"0:"+F$+",S,W"
```

The "0:" is used for the same reason we used it with SAVE. It's not strictly necessary, but we've observed occasional problems when it is left out. The suffix ",S,W" can be spelled out:

```
20 OPEN 1,8,8,"0:"+F$+",SEQ,WRITE"
```

SEQ means a sequential file. For our use, SEQ just denotes a data file, as opposed to a PRG (program file). There are a few other file types, REL (relative) and USR, but we won't cover them here. The "W" means write, and is necessary, since the OPEN statement otherwise has no way to tell the disk whether we want to read or write to the file.

If you need to replace an existing file on the disk, you could use "@0:" in place of "0:", or open the command channel and send a SCRATCH command to delete the old file before you write the new one.

After we OPEN a file, we just PRINT# (say "PRINT-file") our values to it, as we discussed above. Here are some examples:

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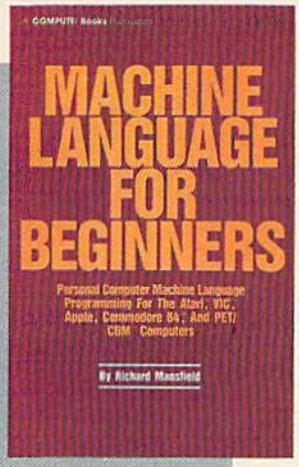
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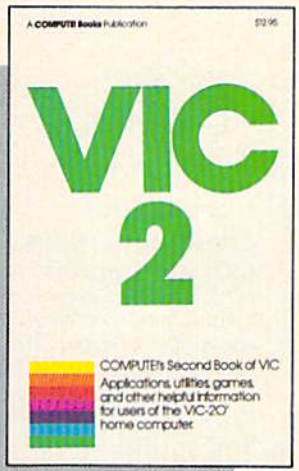
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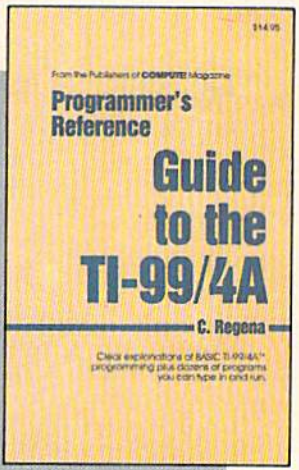

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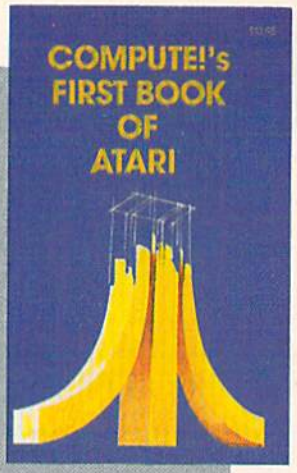

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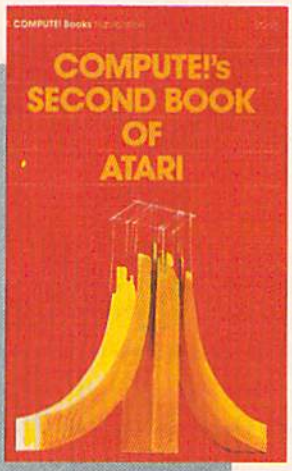

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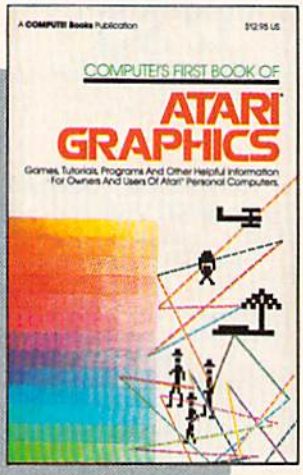

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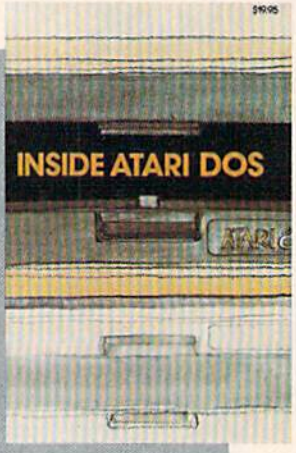

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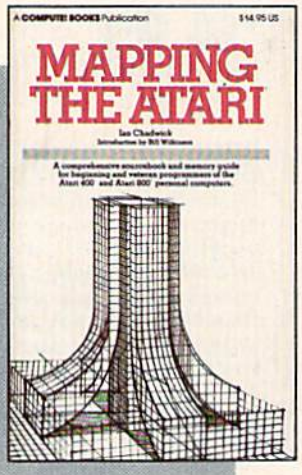

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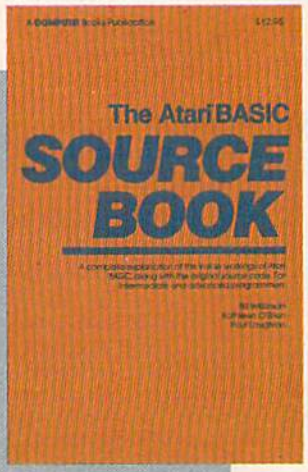

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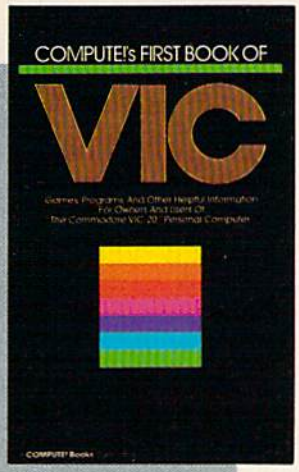

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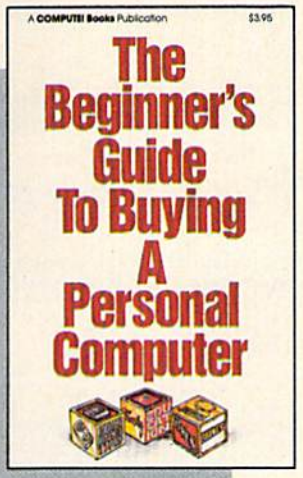

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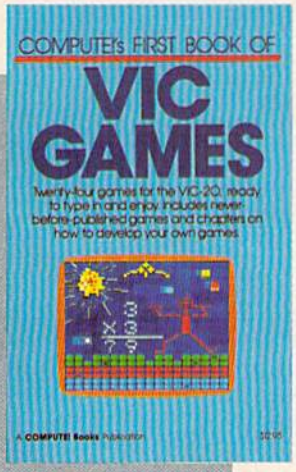

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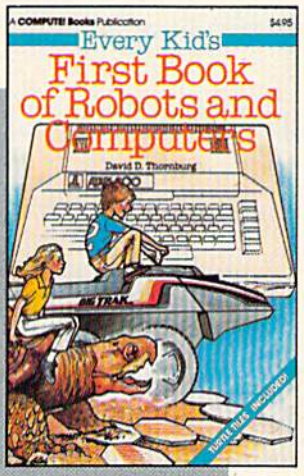

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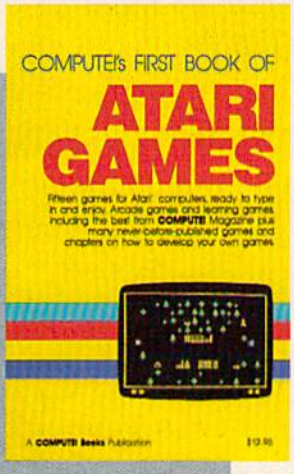

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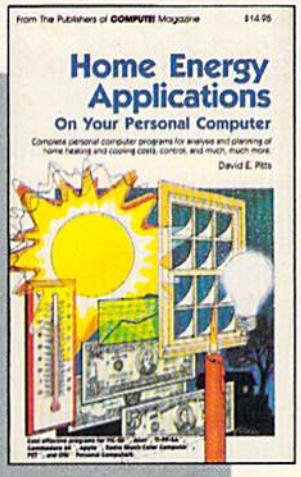

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Save a numeric array:

```
20 FOR I=1 TO 10
30 PRINT#1,A(I)
40 NEXT I
```

Save a two-dimensional string array:

```
20 FOR I=1 TO 3
30 FOR J=1 TO 6
40 PRINT#1,A$(I,J)
50 NEXT J,I
```

Save mixed variables:

```
20 PRINT#1,NAME$;",";AGE;",";DATE$
```

After you PRINT out all the data you want, you have to CLOSE the file, for three reasons. First, you may want to reuse the file number later in the program, and CLOSE makes it available. Second, you can have a maximum of only ten files open at once, so you want to free up a file once you're through. Third, you have to do it anyway. Otherwise, the contents of the last buffer may not be written to the disk. Remember that a buffer will not be written until it fills up with 256 characters. When you are finished sending data, the last buffer might not yet be full. CLOSE makes sure the incomplete buffer is written out.

To use CLOSE, just follow it with the file number: CLOSE 1 will do. You can even CLOSE files which have never been OPENed without causing an error, so some people routinely CLOSE a file before they OPEN it to prevent the ?FILE OPEN ERROR that results when you try to open a file that is already open.

The biggest problem people seem to have with files is not writing them, but reading them correctly. A common mistake is reading the values out of order, or trying to INPUT a string value into a numeric variable. If you remember how the PRINT and INPUT commands work, though, you shouldn't have any problem.

This will open a file named "DATAFILE" which was previously written:

```
100 OPEN 1,8,8,"DATAFILE,S,R"
```

Actually, you can shorten it to:

```
100 OPEN 1,8,8,"DATAFILE"
```

because the disk drive assumes you want to read the file unless you say otherwise, and it will know the file is SEQuential when it finds it.

You can then use the INPUT# command to read the file in the same way it was written:

```
110 INPUT#1,A$
```

Since you are reading values, not variables, you can use any variable name you like.

Here are some examples of INPUT#, following the previous examples. If you parallel your INPUT# to your PRINT#, you can't go wrong:

Read a numeric array:

```
120 FOR I=1 TO 10
130 INPUT#1,A(I)
140 NEXT I
```

Read a two-dimensional string array:

```
120 FOR I=1 TO 3
130 FOR J=1 TO 6
140 INPUT#1,B$(I,J)
150 NEXT J,I
```

Read mixed variables:

```
120 INPUT#1,N$,A,DATE$
```

As shown, you don't have to use the same variable names. Just keep the values in the same order.

After you are finished reading the file, CLOSE it to keep things tidy.

We'll now get into some file techniques. Our examples have been pretty simple, always assuming that the same number of items is always written out. But if you don't know how long the file is, how do you know when to stop reading?

```
10 INPUT "NUMBER OF NAMES";N
20 DIM A$(N)
30 FOR I=1 TO N
40 PRINT "NAME #";I;":";
50 INPUT A$(I)
60 NEXT I
70 OPEN 1,8,8,"0:NAMEFILE,S,W"
80 FOR I=1 TO N
90 PRINT#1,A$(I)
100 NEXT I
110 CLOSE 1
```

This program asks for a list of names, getting the number of names to be entered from the user. It then writes the names to a disk file called "NAMEFILE". Now, if you want to read the names with another program, you don't know how many names were written. The solution: Write N, the number of names, to the file. We can add line 75 to do just that:

```
75 PRINT#1,N
```

We can then easily write a program to read the file:

```
10 OPEN 1,8,8,"NAMEFILE"
20 INPUT#1,N
30 DIM A$(N)
40 FOR I=1 TO N
50 INPUT#1,A$(I)
60 NEXT I
70 CLOSE 1
```

Another method is to write an end-of-file marker, say an asterisk, at the bottom of the file. Then we can read the file until we reach the asterisk. There's another way, too. The computer changes the STATUS variable when it detects an error (STATUS normally equals zero). One such error is end-of-file. If line 75 were not added to the program that writes the file of names, we could still read the file like so:

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```
10 OPEN 1,8,8,"NAMEFILE"
20 DIM A$(50):N=1
30 INPUT#1,A$(N)
40 IF ST=0 THEN N=N+1:GOTO 30
50 CLOSE 1
```

By the way, if you want to look at the names as they come in, you could add a line that will PRINT A$(N) after the INPUT#.

You can also open more than one file at once. This program opens the file we created earlier and writes it to a new file. Along the way, it changes every occurrence of "JOE" to "JACK" (don't ask why):

```
10 OPEN 1,8,8,"NAMEFILE"
20 OPEN 2,8,7,"0:NEWFILE,S,W"
30 INPUT#1,A$:S=ST
40 IF A$="JOE" THEN A$="JACK"
50 PRINT#2,A$
60 IF S=0 THEN 30
70 CLOSE 1
```

We save the value of ST in the variable S, since the PRINT#2 in line 50 may reset it, and we don't want to lose the end-of-file indication.

You can also use GET# to read from a file. This program dumps any data file to the screen:

```
10 OPEN 1,8,8,"FILENAME"
20 GET#1,A$:S=ST:PRINT A$;:IFS=0THEN20
30 CLOSE1
```

Now maybe you want to examine the file as a bunch of ASCII numbers. You might type:

```
20 GET#1,A$:S=ST:A=ASC(A$)
```

Stop before you go any further! There is a problem here. If the program contains any imbedded CHR$(0)'s, ASC will cause an ?ILLEGAL QUANTITY ERROR. You see, CHR$(0) is read by GET as the null string, and ASC will not work on a null string. CHR$(0) is not the same as the numeral 0, which has an ASCII value of 48. Instead, use:

```
GET#1,A$:S=ST:A=ASC(A$+CHR$(0))
```

The ASC function gives you the ASCII value of the first character of the string. Unless A$ is a null string, the appended CHR$(0) won't affect anything. But if A$ is null, then ASC will see the CHR$(0) and return 0, which works fine. A confusing situation, to say the least.

Next month, we'll conclude this series with some miscellaneous material, including answers to frequently asked questions about disk drives. I've shown you only a glimpse of the power of data files. Your disk drive expands your computer's memory, as well as its processing capabilities. Don't treat your disk drive as a glorified cassette unit. Its speed, random access, and convenience can really open up a whole new world of computing capability.

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HOTWARE

A Look At This Month's Best Sellers And The Software Industry

Kathy Yakal, Editorial Assistant

Commodore 64 Entertainment

This Month		Last Month
1	*Jumpman* (Epyx)	2
2	*Temple of Apshai* (Epyx)	3
3	*Frogger* (Sierra On-Line)	4
4	*Fort Apocalypse* (Synapse)	1
5	*Choplifter* (Brøderbund)	6
6	*Gridrunner* (HesWare)	7
7	*Neutral Zone* (Access)	8
8	*Planetfall* (Infocom)	5
9	*Telengard* (Avalon Hill)	–
10	*Witness* (Infocom)	–

Commodore 64 Home/Business/Utility

1	*WordPro 3 Plus/64* With *Spell Right* (Professional)	1
2	*Quick Brown Fox* (Quick Brown Fox)	2
3	*Home Accountant* (Continental)	–
4	*Oracle* (Batteries Included)	10
5	*M File* (M Soft)	3
6	*Paper Clip* (Batteries Included)	9
7	*Money Manager* (Timeworks)	4
8	*Management Systems 64* (Entech)	–
9	*Data Base 64* (Entech)	–
10	*HES Mon* (HesWare)	–

Commodore 64 Educational

1	*Dungeons of the Algebra Dragons* (Timeworks)	5
2	*Facemaker* (Spinnaker)	1
3	*Studio 64* (Entech)	–
4	*Fraction Fever* (Spinnaker)	2
5	*Up For Grabs* (Spinnaker)	3
6	*Primary Math Tutor* (Comm*Data)	4
7	*Pipes* (Creative Software)	–
8	*Touch Typing Tutor* (Taylormade)	7

VIC-20 Entertainment

This Month		Last Month
1	*Gridrunner* (HesWare)	1
2	*Shamus* (HesWare)	3
3	*Temple of Apshai* (Epyx)	4
4	*Choplifter* (Creative Software)	3
5	*Crush, Crumble and Chomp* (Epyx)	5
6	*Predator* (HesWare)	7
7	*Attack of the Mutant Camels* (HesWare)	–

VIC-20 Home/Business/Utility

1	*Quick Brown Fox* (Quick Brown Fox)	1
2	*Turtle Graphics* (HesWare)	2
3	*Household Finance* (Creative Software)	5
4	*HES Mon* (HesWare)	4
5	*TOTL Time Manager* (TOTL)	–
6	*TOTL Text* (TOTL)	–

VIC-20 Educational

1	*Touch Typing Tutor* (Taylormade)	1
2	*Type Attack* (Sirius)	3
3	*Word Search* (T & F)	–
4	*Sky Math* (UMI)	–
5	*Primary Math Tutor* (Comm*Data)	2

Top 40

Comparing The Software And Record Industries

Kathy Yakal, Editorial Assistant

This month's HOTWARE examines some of the similarities and differences between the personal-computer software industry and the record industry.

Personal computers, some say, cannot be fairly compared to any other consumer product that has existed up to now. Computers are unique; no other technology allows so many applications for so little money.

But interesting parallels can be drawn between the computer and record industries. You could say that an amplifier/receiver is comparable to a computer; a turntable or tape deck is like a disk drive or tape drive; and that records and tapes are "software," like floppy diskettes and program cassettes.

The analogy is not perfect, of course. A stereo system is useless without software in the form of records, tapes, or radio broadcasts, but a computer can be programmed by the user to perform an infinite number of functions. In that sense a computer is more like a musical instrument, a creative tool.

True, with a stereo cassette deck, you can record off the radio, or make a copy (in violation of copyright laws) of a friend's cherished Beatles album, just as you can copy a spreadsheet program with a computer. But computers are multifunction machines. Some people argue that for a stereo to be comparable to a computer, it would have to be easily convertible into a dishwasher or a microwave oven or a vacuum cleaner. You can play different kinds of music on a stereo, but it's not exactly the same as running different programs on a computer.

Further, the potential of the two industries is very different. Although audio technology is improving rapidly (largely because of computer technology, in fact), stereos will always remain, basically, music-playing machines. But we can hardly imagine what computers will be like someday.

A New Kind Of Software

Kapri International, of Sun Valley, California, has been producing and distributing gospel and classical records for the last 20 years. Its employees have seen incredible growth and myriad changes in the record industry.

Now, in 1984, it's one of the largest distributors of software for Commodore computers in the country, possibly the largest. Kapri carries well over 1000 different titles from about 100 independent software publishers and distributes them to a network of more than 1200 dealers.

Kapri still does some business in record albums, but its primary product these days is software. "We started carrying Atari software in 1980, when we saw that software was going to be a big business," says Kapri president Chris Soular. "Record sales were beginning to drop off on a national level at about that time anyway, due partly to pirating and high prices."

When Commodore announced its VIC-20 in 1981, Kapri took notice. The VIC, at $299, was the cheapest microcomputer available at that time. It was a real computer, not just a game machine. And a number of independent software publishers, responding to the public's quick acceptance, began producing a lot of software for it.

"We saw lots of potential in the VIC-20," says Soular. "And when the 64 came out in 1982, we knew that Commodore was going to be a hit." Kapri dropped its Atari line and concentrated on Commodore software. Soular still doesn't regret that decision. "Commodore is like the Michael Jackson of the computer industry today," he says.

Not So Different

Software publishers view piracy as a growing problem, as do record companies. Most programs have some kind of "copy protection"—a way to keep people from making illegal copies—but clever programmers can often break the protection.

"Pirating is not as big an issue for the software industry as it is for the music business," says Soular. "It is still a lot easier to tape an album or something off the radio than it is to break into a piece of software. But it does cost the industry a lot of money."

Another similarity, says Soular, is the need for industry people to identify with their potential customers. "There can't be a generation gap there. Not only must we be able to evaluate a product and tell whether or not it is good. We have to know what age group is going to be interested in it, and whether they will buy it."

Generally, records are recorded and software written to appeal to one particular age group. There are, of course, exceptions.

The target age group, Soular thinks, is similar in both the software and record industries. It's young.

"In both businesses, you must have a young enough mind to pick the hits," he says.

Even though the product he now delivers to retailers is different, Soular finds he must promote software in some of the same ways he did records. "We still do mailings and print up and distribute newsletters and brochures," he says. "Only now, instead of calling radio stations and record stores, I'm calling computer stores and trade journals."

Price And Support

Support for retailers is one area where Soular sees differences between the two industries. The National Association of Records Merchandisers (NARM) is a kind of support group for people in the industry. Retailers and distributors stay in touch through this national network. They keep each other in touch with what's happening and try to plan for the future.

No such organization exists for Commodore software dealers, says Soular, but he is trying to create one. To be called the Independent Commodore Software Dealers Association, it will set up a network similar to that of NARM's. It plans to work closely with Commodore itself to provide information and resources for dealers. Advertising co-ops (in which dealers receive subsidies for ads) and bulk ordering are expected to give dealers a financial break in the heated price wars with mass merchandisers and discount houses. Soular expects to have 150 dealers involved by Christmas.

But differences between the record and software industries will call for somewhat different strategies. One of the most obvious differences is pricing. "Records started out very cheap and got more and more expensive," says Soular. "When people started selling software for personal computers, there was no industry standard. They could have compared it to software for larger business machines, but that would have looked ridiculous. People wouldn't pay hundreds of dollars for one piece of software they bought to use with a computer that cost $299. So they brought the price down to what they thought was fair.

"So the big guys were charging a lot of money for their software. Along came these little guys who had fairly good packages for a lot less. The big guys had to lower their prices to keep selling. Prices are getting a bit more reasonable, and I think they'll probably come down some more and then stabilize."

The relationship between product development and pricing can also be dissimilar in the two industries, notes Soular. "A band could work on an album for five or six months and spend hundreds of dollars making a record. Then it sells for $6.99. On the other hand, you've got software writers who can write a program in a month or two—spare time, even—and sell it for $89.95. It's a very young industry, though. Things will change."

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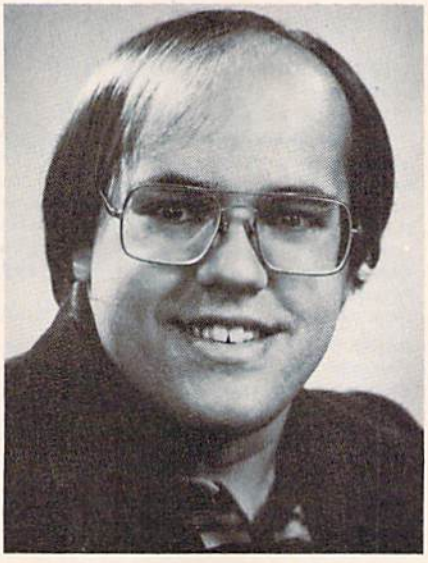
Steve Punter
The Programmer Behind *WordPro*

Selby Bateman, Assistant Features Editor

When the conversation among Commodore users turns to word processing, the name of Steve Punter is usually not far behind. Creator of the hugely successful *WordPro* word processing package, Punter is a 25-year-old Canadian-based programmer who has quickly made a name for himself. Here, he offers his comments on the future of *WordPro*, his own approach to writing programs, and the characteristics that separate the top programmers from the crowd.



Steve Punter, author of WordPro.

The data processing teachers who used to shoo young Steve Punter away from his Toronto high school's Wang 2200 computer would today more likely invite him back as a graduation speaker. In those days, every time a data processing class would arrive to use the Wang, there was Punter huddled over the hardware.

"I kept pestering them, so they finally had to stop me from coming into the room," Punter says, laughing. "I was banned from going near it."

That initial experience with computing in 1976 only whetted his appetite. Now, as a seasoned programmer with a proven track record, Punter is exploring the farther reaches of word processing, bulletin board software, and a variety of other programming areas.

WordPro 3 Plus/64, which Punter has been developing and refining in various forms since 1978, has become the top seller among the Commodore 64 home, business, and utility software packages. Its range of features and ease of use account for its popularity and reflect Punter's approach to programming. In addition to his successes with *WordPro*, Punter has written all of the software used by Commodore bulletin board systems in the United States. He has been running his own bulletin board since April 1981.

After finishing grade 13 in high school (Ontario is the only Canadian province that still has a grade 13), Punter jumped into programming rather than college. The results have been electrifying for him. In addition to his heavy programming schedule, Punter also teaches a course in BASIC at the York Main Library in Toronto. Yet, he has never taken a single computer course himself.

Punter first began programming on a Texas Instruments programmable calculator. The experience convinced him of his interest and his talent. "I learned all of the ropes of programming on that," he says, "especially how to get big programs to fit in little spaces."

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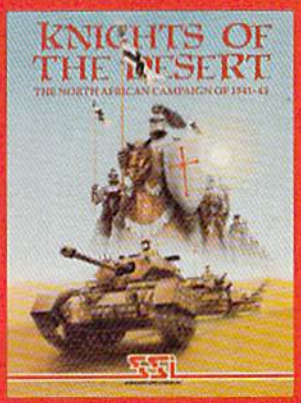

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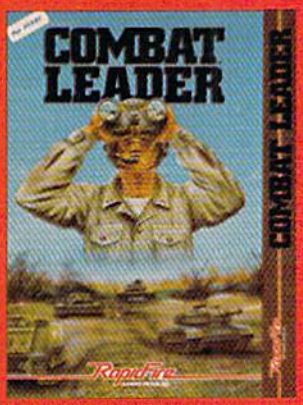

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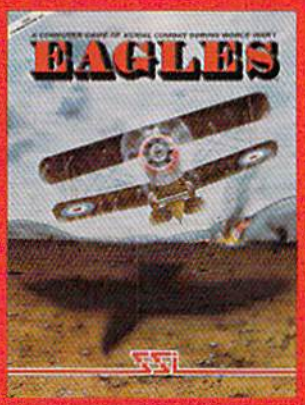

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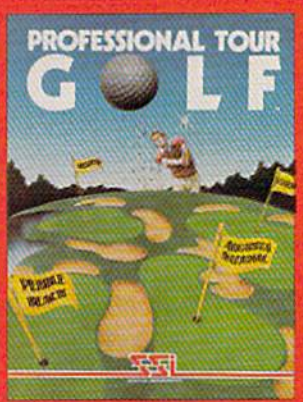

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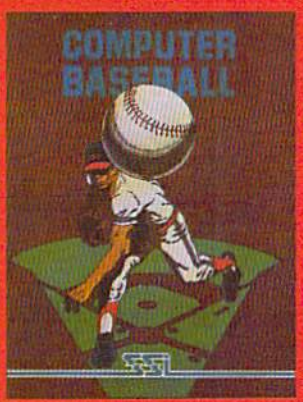

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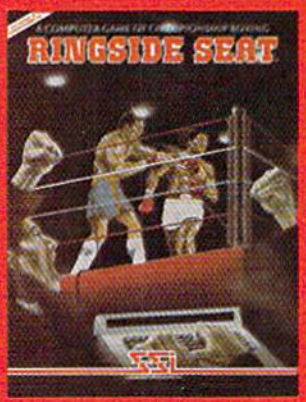

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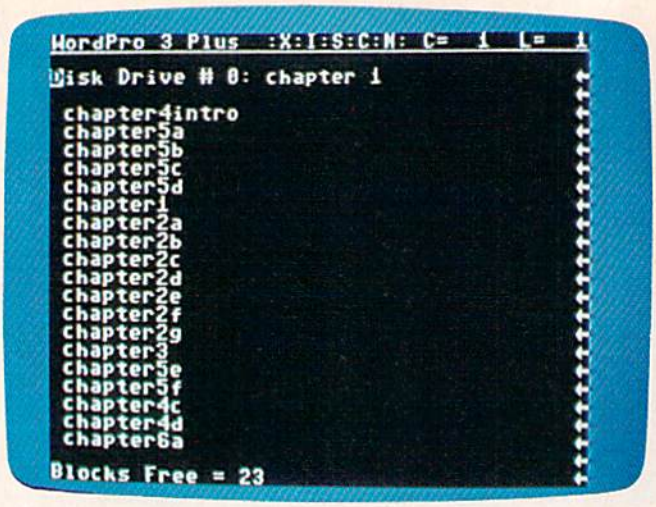

The WordPro 3 Plus *directory displays filenames and blocks free.*

WordPro originated from Punter's attempt to write a text-editing program rather than a full-blown word processor. But feedback from computer users about their word processing needs started him on the trail of something more. With Stuart Martin, who was among the first to recognize *WordPro*'s potential, Punter formed Pro-Micro Software Ltd.

Today, after developing successive forms of the program, Punter is writing *WordPro 64*. This new program, he says, will encompass all the features he believes belong in a word processor. Some examples: truly proportional spacing, with separate printer drivers for printers which need them; double-column printing; and screen formatting that will not break words at ends of lines (*parsing*), a real boon in proofreading.

From his own experiences and observations of other software writers and programs, Punter has some clear thoughts on what separates first-rate programmers from the also-rans: originality, understanding the users' needs and possible mistakes, and taking the care to create speedy, easily handled programs.

"The ones who aren't the top programmers are the ones who can't come up with their own ideas. They copy everyone else, and they're not going to gain the recognition," he says. "Another step is that you have to understand what the user is going to encounter. A lot of programmers I've seen don't really take that into account. Subsequently, those programs are either easy to crash or easy to mix up. It's very important that the programs be bullet-proof—that's a word that's been coined over the years. Besides being bullet-proof, a program must be easy to understand."

Many programmers today favor a multiple-menu approach to software, and Punter agrees that the concept is valid. But he also thinks that quick and logical keystroke commands make programs even easier to use. Although he admits his approach may require extra effort of the user at first to learn the commands, Punter is convinced that the end result is much faster and simpler handling over the long haul. *WordPro* is based on that principle.

A bachelor who lives in one of North America's most exciting cities, Punter gets away from programming with interests in music and video, science fiction reading and conventions, and occasional long drives.

"Sometimes I go through periods when I don't do a thing because I just can't come up with anything new. Then I get these times when I sit down and program and program. It comes and goes," he says.

"I get people around me who say, 'Oh, you're just being lazy' when I'm not working. And sometimes I do feel guilty for spending, say, a week or two without doing a thing. But occasionally that's good for me. Then it clears up all of the dead ends I've run into."

Punter is less than certain that ten years from now he will still be writing programs with the same zeal. But in the immediate future, at least, Commodore users can expect a few more interesting software products from the author of *WordPro*.

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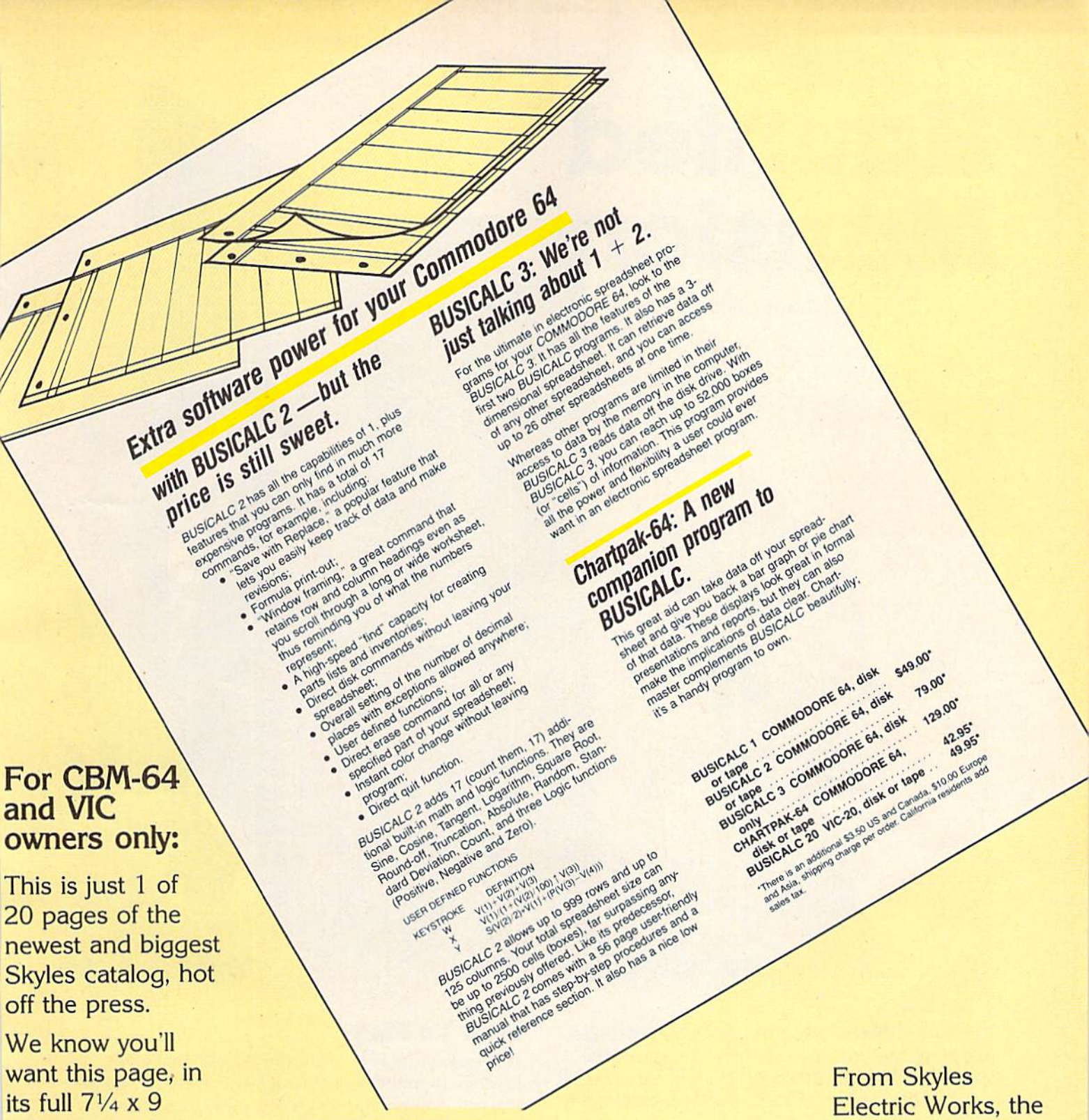

Extra software power for your Commodore 64 with BUSICALC 2—but the price is still sweet.

BUSICALC 2 has all the capabilities of 1, plus features that you can only find in much more expensive programs. It has a total of 17 commands, for example, including:

- "Save with Replace," a popular feature that lets you easily keep track of data and make revisions;
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- "Window framing," a great command that retains row and column headings even as you scroll through a long or wide worksheet, thus reminding you of what the numbers represent;
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- User defined functions;
- Direct erase command for all or any specified part of your spreadsheet;
- Instant color change without leaving program;
- Direct quit function.

BUSICALC 2 adds 17 (count them, 17) additional built-in math and logic functions. They are Sine, Cosine, Tangent, Logarithm, Square Root, Round-off, Truncation, Absolute, Random, Standard Deviation, Count, and three Logic functions (Positive, Negative and Zero).

USER DEFINED FUNCTIONS	
KEYSTROKE	DEFINITION
W	V(1)+V(2)*V(3)
X	V(1)*(1+(V(2)/100)*V(3))
Y	S(V(2)/2)*V(1)+(P(V(3)-V(4)))

BUSICALC 2 allows up to 999 rows and up to 125 columns. Your total spreadsheet size can be up to 2500 cells (boxes), far surpassing anything previously offered. Like its predecessor, *BUSICALC 2* comes with a 56 page user-friendly manual that has step-by-step procedures and a quick reference section. It also has a nice low price!

BUSICALC 3: We're not just talking about 1 + 2.

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Whereas other programs are limited in their access to data by the memory in the computer, *BUSICALC 3* reads data off the disk drive. With *BUSICALC 3*, you can reach up to 52,000 boxes (or "cells") of information. This program provides all the power and flexibility a user could ever want in an electronic spreadsheet program.

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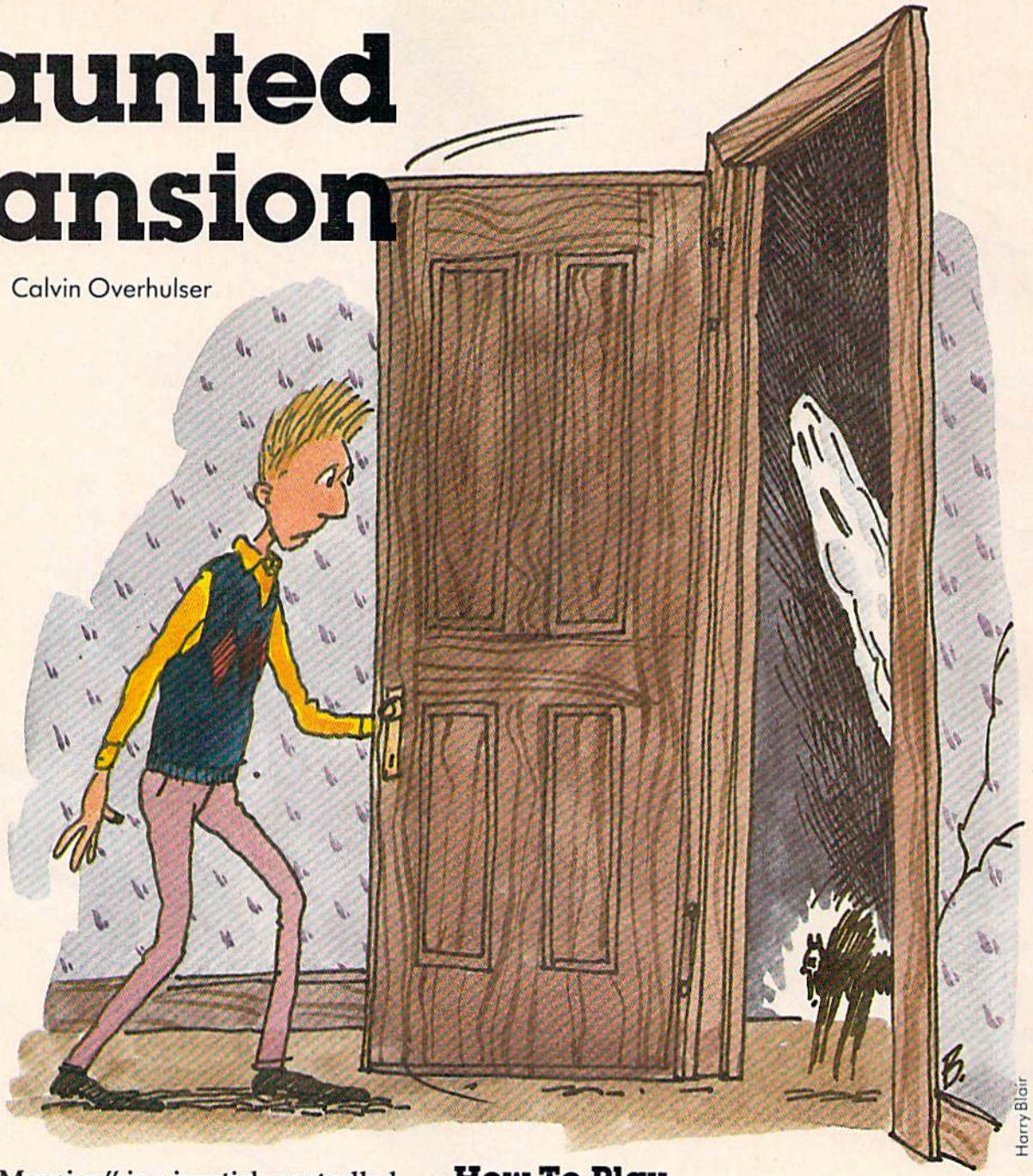
Haunted Mansion

Calvin Overhulser



Harry Blair

"Haunted Mansion" is a joystick-controlled action game with colorful and imaginative graphics. Written for the VIC with at least 3K expansion, we've added a version for the 64.

An evil witch has captured some friendly neighborhood cats and taken them to her haunted mansion, where she will later turn them into "witch cats." She is out flying on her broom in search of more—so now is your chance to enter the mansion and rescue the cats. The witch's mansion is a maze of corridors, and she has placed the cats in various locations throughout the maze. Your goal is to rescue the cats while avoiding ghosts, bats, and evil spirits.

How To Play

After selecting one of six skill levels, use your joystick to maneuver through the maze to one of the cats. When you've got him, return to the bottom row of the maze, the only safe spot for felines in this game. If you run into a ghost or bat on your return, you'll drop the cat and lose points. The frightened cat will then jump to another random location in the maze. The ghosts and bats aren't deadly. When you run into one, you eliminate it, but lose points. At the higher skill levels, you'll have to sacrifice points by deliberately running into the ghosts or bats to clear a path to get to a cat.

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Menacing demons surround the player (right center) in this VIC game of "Haunted Mansion."

lanterns). If you run into one of them, there's no second chance—the game ends, and your final score, skill level, and round are displayed. You will then be given the option to play another game and choose a skill level. The higher skill levels award more points but are more difficult.

For VIC Users

If you have a VIC, you must use a memory expander. If you use a 3K expander, just type in the game (read Typing Tips at the end of the article) and run. If you use 8K or greater expansion, type in the following line before loading or entering the program:

```
POKE 642,32:SYS 58232
```

Be sure to enter this line in immediate mode and press RETURN before loading the program, as it is necessary to move the start of BASIC to the beginning of the first 8K expansion block of memory.

How The VIC Version Works

I have included REMs for the major subroutines to show how the program is logically constructed. The main loop is in lines 210–240. Lines 300–307 are used to update the location of the cat saver (the player) and the selected evil spirit. The ON...GOSUB in line 215 for the cat saver and in line 630 for the selected evil spirit allows the new location for either to be calculated using the same subroutines.

To speed up the joystick response, I used a machine language routine which is READ in line 120 and POKEd into the cassette buffer. The DATA statements are found in lines 9000–9040. The SYS in line 210 calls the routine, which places the value of the joystick reading in location 830 and the fire button reading in location 831.

If you think of the joystick positions as points on a compass, you can see the joystick values in location 830 as follows:

Joystick Position	Value in 830
None	0
N	1
NE	2
E	3
SE	4
S	5
SW	6
W	7
NW	8

The fire button values are contained in location 831 as follows:

Fire Button	Value in 831
ON	16
OFF	0

This routine allows the BASIC program to PEEK(830) or PEEK(831) as needed, and it reads the joystick twice as fast as an equivalent BASIC routine. In this game, the fire button is not used and only joystick positions N,S,E, and W are needed. The beauty of this routine is that it returns all conditions of the joystick and fire button, but you use only the ones you need.

If you've already looked at the game, you've probably noticed the custom characters. The first 64 normal VIC characters are moved by line 110 into Random Access Memory (RAM). Lines 130–150 then READ and POKE the DATA statements (lines 10000–10190) for custom characters into RAM. Line 100 lowers the top of memory (only when running with the 3K expander) to protect the custom character set from being obliterated by BASIC. Incidentally, creating the custom characters was not such a chore because I used David Malmberg's "Custom Characters For The VIC" program from *COMPUTE!'s First Book Of VIC*. Table 1 lists the custom characters and their screen codes.

"Haunted Mansion," 64 version.

TAKE A BREAK!

For Commodore 64

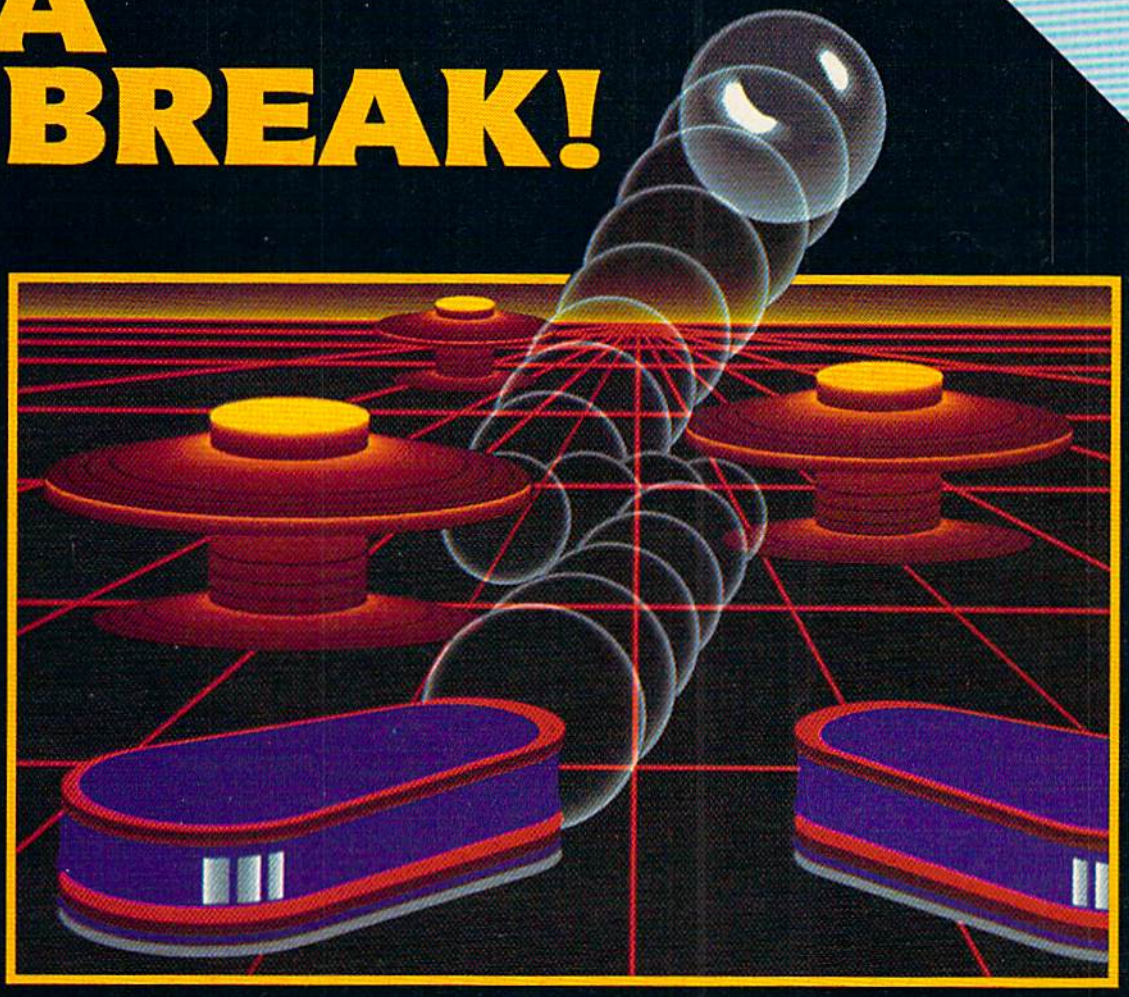

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Table 1: Custom Characters

SCREEN CODE	ORIGINAL CHARACTER	CUSTOM CHARACTER
27	[	Witch
28	pound	Witch
29	]	Witch
30	↑	Witch
31	←	Evil spirit
35	#	Solid block
36	$	Moon
37	%	Moon
38	&	Moon
39	'	Moon
40	(	Moon
41	)	Moon
42	*	Moon
43	+	Moon
44	'	Roof
45	−	Roof
58	:	Cat saver
59	;	Ghost
60	<	Cat
61	=	Bat
62	>	Space (outside house)

Note that there is a custom character "space" (screen code 62) in addition to the normal space (screen code 32). This allows the same character to be displayed on the screen with both codes, but allows the program to tell the difference. The normal space is used inside the mansion, and the custom character space is used outside. This keeps the cats, bats, ghosts, and evil spirits from appearing in the sky since they can be placed only in a location containing a normal space.

The game screen is built in lines 1000–1093, and the maze is generated in lines 1200–1292. Variable names, listed in Table 2, are used more than once where possible to conserve memory.

Table 2: Program Variable Names

VARIABLE	DESCRIPTION
A	Variable in READ statements.
I	Miscellaneous counters in FOR/NEXT loops + random numbers.
J	Random number.
N	Counter in FOR/NEXT loops.
O	Constant = 0.
P	Constant = 1.
Q	Constant = 22.
V	Volume (36878).
X	Counter in FOR/NEXT loops + random numbers.
Z	Current location to be updated in subroutines 300–307.
AA	Skill level.
A$	String for GET statements.
BL	Flag to place character.
CC	Cat counter.
CF	Cat flag CF = 4 means carrying cat.
CL	Current location for cat saver.
CM	Difference between color memory and screen memory.
DF	Dead flag.
HL	Constant = 32.
RN	Number of current round.
SC	Screen RAM location.
SR	Current score.
SH	Sound high (36876).
SL	Sound low (36875).
TL	Temporary storage for CL or A(I) during update.
WL	Constant = 35.
A(0) – A(3)	Variables for maze generator.
A(1) – A(13)	Locations of evil spirits.

Typing Tips

This is a long program to type in, so be sure to use the keyword abbreviations found in Appendix D of *Personal Computing on the VIC-20*, which came with your VIC. *Don't add any spaces*! At certain points in the program, there are only about 100 bytes free when using the 3K expander. If you'd rather not type in the program (VIC version only), send a self-addressed stamped mailer, a blank tape, and $3 to:

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See program listings on page 185.

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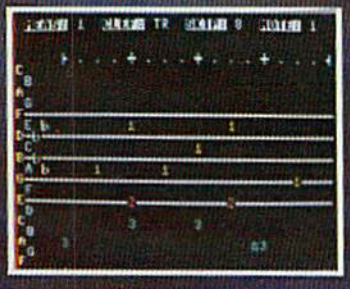

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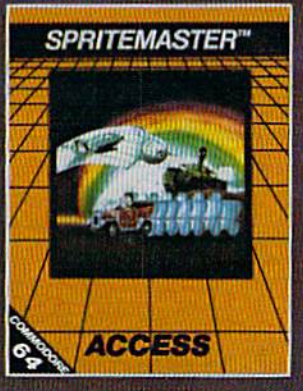

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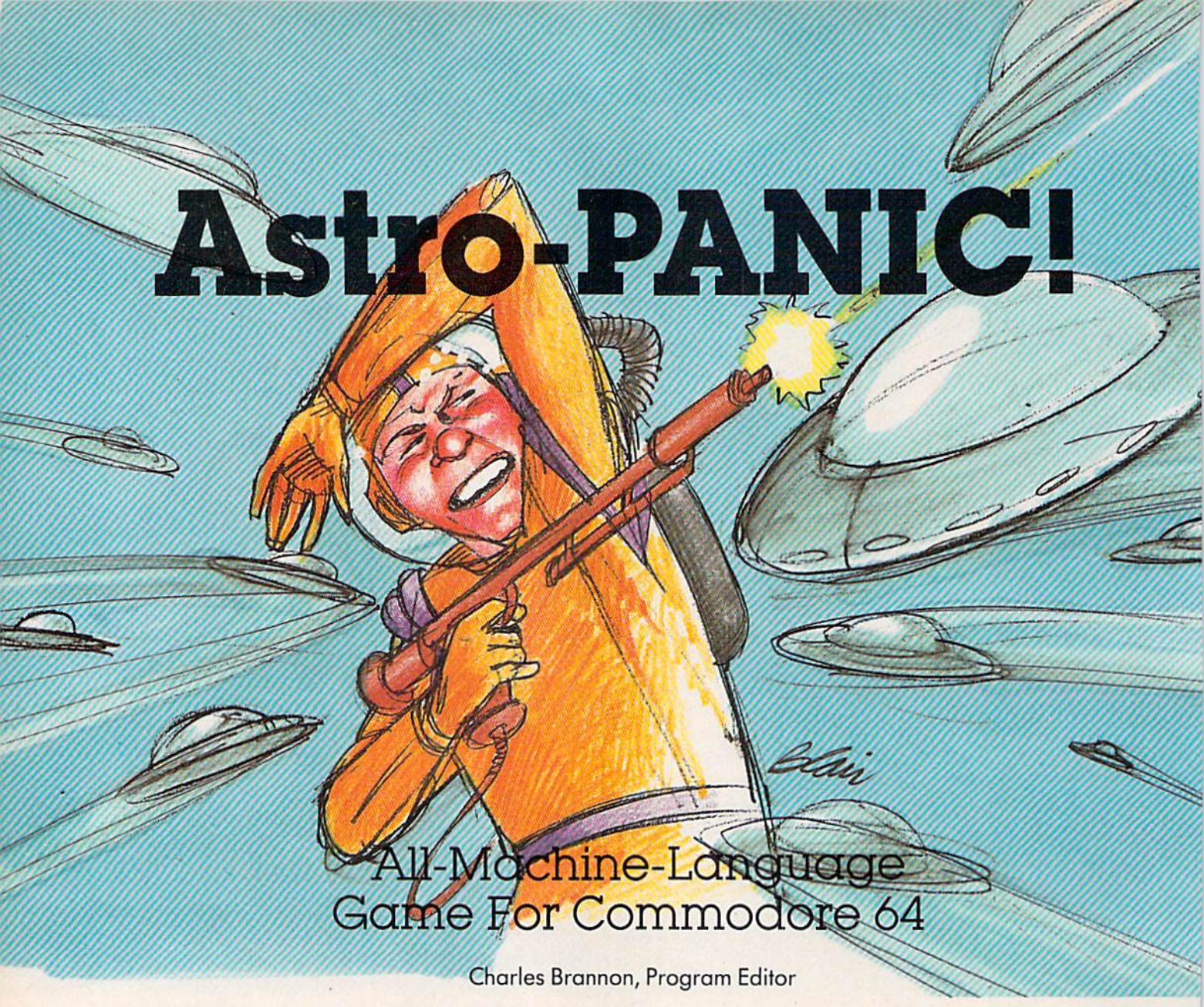
Astro-PANIC!



All-Machine-Language Game For Commodore 64

Charles Brannon, Program Editor

Written entirely in ultra-fast machine language, "Astro-PANIC!" is an arcade-style space game with multicolored sprites and 15 frantic levels of difficulty. Will you be the first human to make it to level 15?

"Astro-PANIC!" is a fast-paced, high-speed, all-machine-language game. The object is to defend your cannon, maneuvering it left and right as alien saucers dodge and dive in a relentless attack.

Plug a joystick into control port two to play. After loading from tape or disk (see special instructions below), enter SYS 49152 to run the program. The screen clears to black with a gray score window at the bottom. Press the f7 function key to begin.

Swooping Saucers

Instantly, seven alien saucers begin to sweep about the screen. Saucers always keep moving in their current direction until they hit a screen boundary, then they rebound, sometimes changing their speed. Meanwhile, you move your cannon left and right to evade the erratic dives and swoops of the saucers. The slightest contact with an alien saucer spells destruction.

Fortunately, you have your Super Weapon, a laser/heat-ray/particle-beam/thermonuclear ray gun. Simply press the trigger button on the joystick to unleash a bolt of this incredible power. The bolt continues until it hits a saucer, atomizing it, or until it reaches the top of the screen. If you hold down the fire button, the bolt continually repeats.

You can pause the game at any time by pressing SHIFT, or freeze it by depressing SHIFT LOCK. Simply press SHIFT LOCK a second time to continue the game.

Scoring is determined by how close you are to the saucer when you hit it. Since the saucers

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Enemy saucers (multicolored sprites) hover and dive upon the defending player in this game of "Astro-PANIC!"

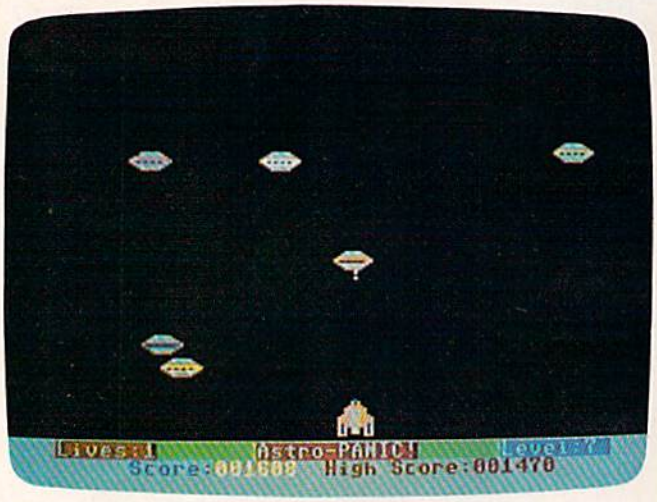
are more dangerous near the bottom of the screen, you get more points for shooting them there. The score is derived from the saucer's position (31 to 210) divided by 8.

If you destroy all seven saucers, you advance to a new screen. Each level is faster than the previous one and is indicated in the score window (1–15). Be warned—levels ten and above are manic!

You lose a cannon whenever a saucer collides with you. The game is over after you lose all three cannons to the marauding saucers. The scoreboard keeps track of the high score during the current session. Press f7 to start another game. Watch the time, though: Some people don't know when to quit!

Playing Tips

Keep moving. It is more important to protect your cannon than to make that tricky shot. Dodge the aliens first, shoot later. You won't always want to hold down the fire button to repeat, since sometimes a shot will be in the air when you'd rather shoot the alien right above you. Keep an eye on the movement of the saucers, so you can sometimes synchronize several wipe-out shots. Watch out for the edges of the screen. Aliens will sometimes bounce off an edge right into you.



An attacking saucer is zapped at midscreen in level 7.

Typing The Program

To type Astro-PANIC!, use MLX, the Machine Language Editor, which virtually guarantees foolproof entry of machine language programs. You'll find a complete description elsewhere in this issue. Here is the information you'll need to enter Astro-PANIC! with MLX:

Starting address—49152
Ending address— 50777

After you are finished typing, MLX will let you save the program to tape or disk. Thereafter, just LOAD "filename",1,1 for tape or LOAD "filename",8,1 for disk, then SYS 49152 to begin.

During our testing of Astro-PANIC!, no one ever made it beyond level 12. Level 15 is waiting for the truly wired. Keep a sharp eye for any strange-looking lights in the sky.

See program listing on page 174.

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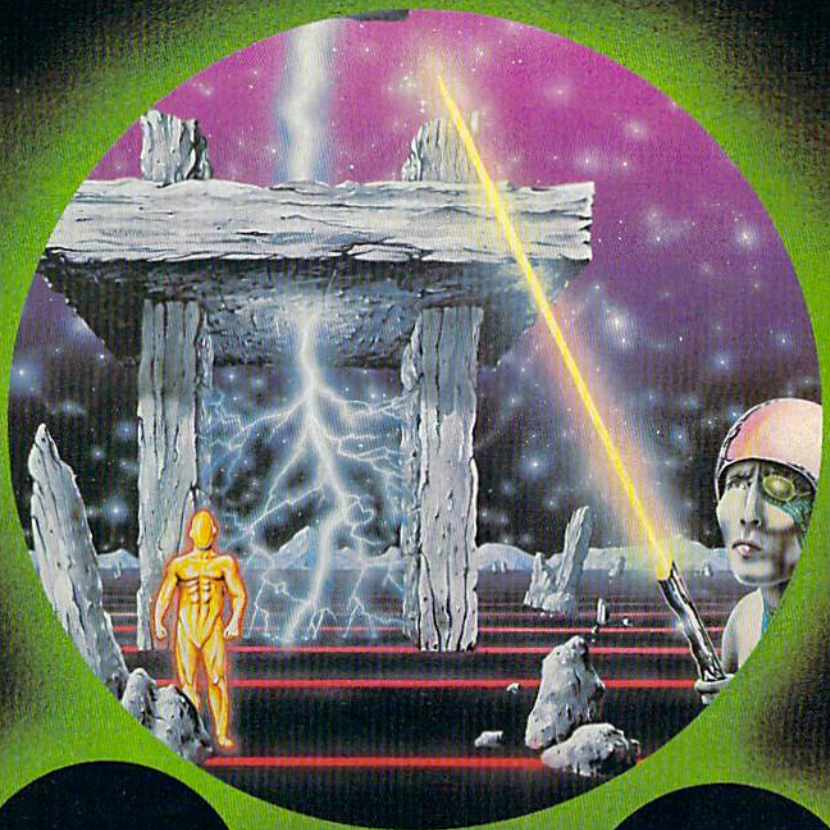

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COMMODORE 64 SOFTWARE

Ski thru' Marine Maniacs, G&Ts, Regattas but beware the Great White Hungry!! AQUAPLANE is an unbelievable original Arcade Game.

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SKYHAWK
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Attacking raiders scream out of the sky at you, you check your radar as an explosion blossoms at your side, you return their fire sending one of the attackers plummetting, the fuel gauge flashes a low fuel warning... SKYHAWK runs in 3K or 8K with a Joystick.

TORNADO
VIC20 SOFTWARE

Suddenly attacking Colony Fighters leap at me, I dive into their midst firing and still bombing the ground installations below, the sound of explosions rumbles away over the landscape... TORNADO runs on an unexpanded VIC20 + Joystick.

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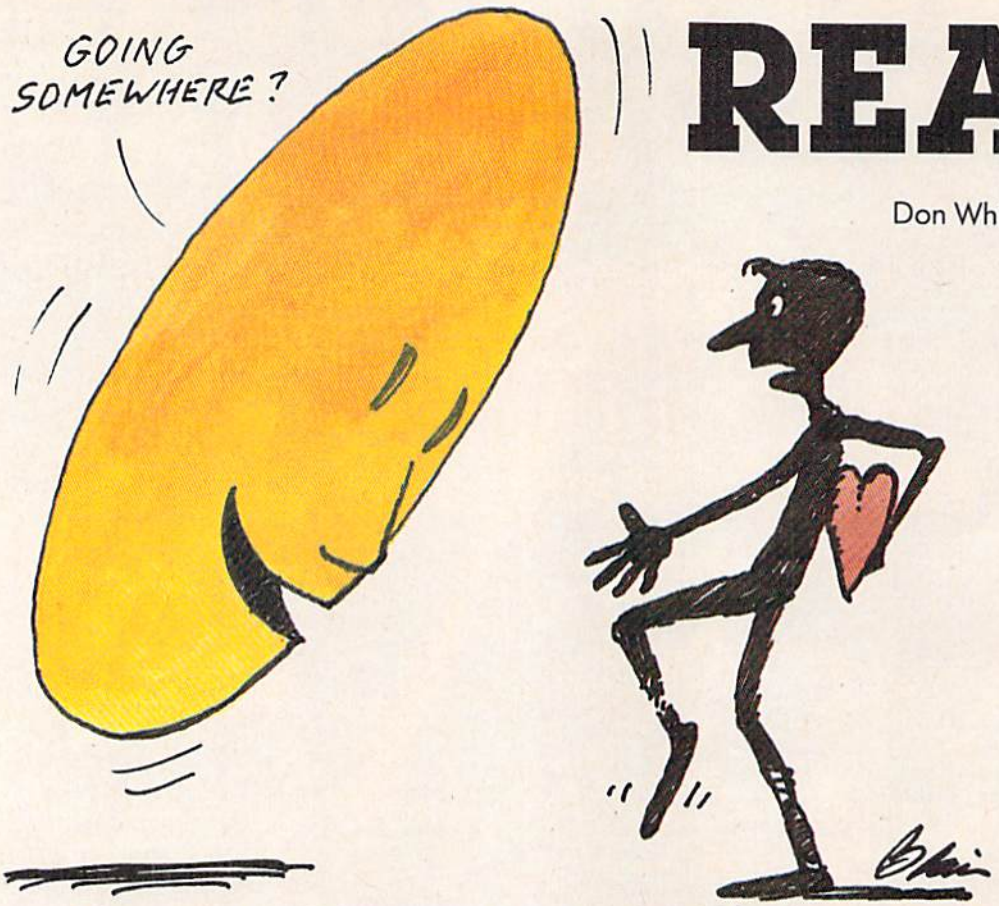

REACT

Don Whitaker

"React" is a fast-action, strategy game for the unexpanded VIC and Commodore 64. A joystick is required.

"React" is a colorful, fast-action game in which your joystick-controlled character, called a "Maynerd," must clear the screen of all the prizes. What's difficult is avoiding the electric fence, the guards (who look like smiling faces, but they're actually leering at you), and your own trail (a solid colored line you leave behind).

How To Play

You begin the game with five Maynerds. Press the fire button to start. After the screen appears, use your joystick to move your Maynerd to one of the colorful prizes. After a few tries, you'll discover that React is not only an action game, but also a strategy game. If you randomly collect prizes, you might find that you've boxed yourself in and can't get to one of the remaining ones.

If you run into the electric fence, a guard, or your own trail, your Maynerd is eliminated. The screen displays your score, the number of Maynerds remaining, and bonus points. Each round gets harder as you have more fences and guards to avoid.

The only real way to amass points or play competitively is to collect bonus points, which are awarded when you clear the screen in less than 60 seconds. There is no clock on the screen, but you do hear the timer ticking away. The faster you are, the higher your bonus.

Typing In The VIC Programs

Programs 1 and 2 are for the VIC (no expansion memory required), and Program 3 is for the 64. VIC users should use keyword abbreviations (such as ? for PRINT). For a complete list of these, see Appendix D of *Personal Computing on the VIC-20* (the manual which comes with the VIC). Also, don't use unnecessary spaces. React uses virtually all of the VIC's memory.

Type in Program 1 and SAVE it twice (just to be safe). Then enter NEW, type in Program 2, and SAVE it twice. Next, LOAD and RUN Program 1. The screen will display "DO YOU WANT TO CENTER THE SCREEN? (Y/N)." If your TV is a little out of adjustment, use the cursor controls to adjust the screen up, down, right, or left. Pressing RETURN will automatically load Program 2 and run React.

If you're using disk, press RUN/STOP after Program 1 has RUN, and LOAD Program 2.

How The VIC Version Works

Program 1 creates the custom character set and allows you to center the screen. Program 2 is the main game. Here's a description of both programs:

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Superbase 64 T.M.

Precision Software

Precision Software (USA), Inc.
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NEW YORK
N.Y. 10128
(212) 410 3418

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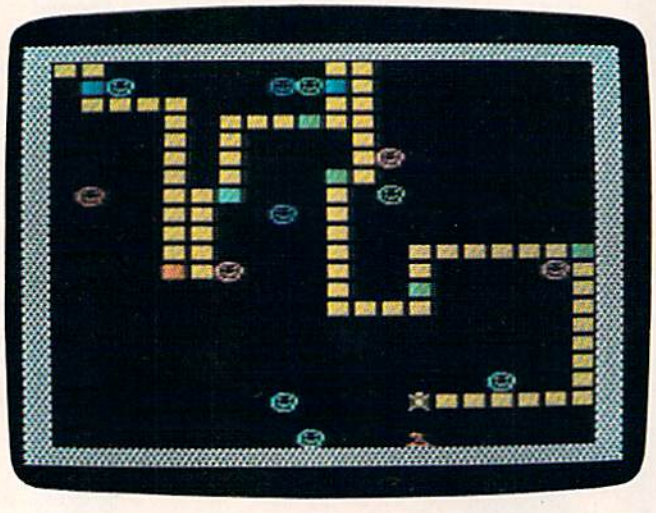
Program 1.

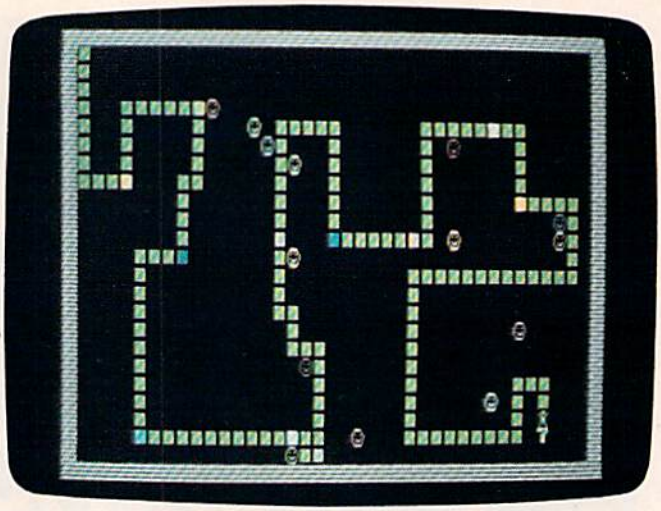
Lines	
10–40	Clear screen, change screen colors, print screen-centering option.
50	Clear screen, change screen color to black.
70	Reserve an area of memory for new character set.
80	Copy characters (uppercase letters and non-graphic symbols) to memory locations 7168–7679.
120–166	Redefine new characters.
170	Delete Program 1, then load and run Program 2.
10000–10009	Screen-centering subroutine.

Program 2.

Lines	
5	Set a maximum volume for game sound.
10	Clear screen, set character color to black, and change screen colors.
20–28	Print title.
30–40	Add sound effects and color to title.
109–130	Define variables.
135–136	Cause delay while waiting for fire button to be pressed.
160	Change screen color to black and switch to alternate character set.
180	Branch to screen-drawing subroutine.
190–210	Randomly color and locate the guards.
220–240	Randomly color and locate the prizes.
249	Set realtime clock to 0.
250	Begin main loop. Place Maynerd in starting position and read joystick.
260	Check for collision with fence, guard, or trail. On collision, branch to "lose Maynerd" subroutine.
270	Check to see if Maynerd has moved.
280	Check to see if Maynerd has collected a prize.
290	Cause "running feet" sound, increment score, update Maynerd's position, and return to line 250.
390	Check to see if fire button was pressed.
400–420	Check joystick position.
440–450	Draw basic game screen.
460–550	Add more fences to screen.
560–580	"Lose a Maynerd" subroutine. Change screen border to yellow, sound explosion, and check to see if any Maynerds are left.
600–610	"You got all the prizes" subroutine. Cause sound and color display, determine bonus, and add it to score.



Maynerd claims prizes while avoiding the smiling guards and his own trail in the VIC version.



This Maynerd has almost completed a successful run in the 64 version.

620–650	Display score, number of Maynerds left, and bonus from previous screen.
660–670	Wait until fire button is pressed.
680–720	"Game over" subroutine. Display high score and most current score. Wait for press of fire button to start new game.

Program Variables

CO	Memory location (36879) for screen and border colors.
SM	Screen code value (28) for a guard.
ML	Number of Maynerds left.
C	Difference between screen memory and screen color memory (30720).
ER	Screen code value (32) for a space.
MA	Screen code value (0) for a Maynerd.
TR	Screen code value (30) for Maynerd's trail.
WA	Screen code value (31) for electric fence.
S	Memory location for voice two (36875).
V	Memory location for volume control (36878).
NE	Constant for adding to score.
SC	Current score.
NM	Number of guards.
NC	Number of prizes.
CL	Current number of prizes still on screen.

JS(X,X) is an array used to translate the joystick position to numbers that correspond to Maynerd's movement.

DD, PA, PB, OP, TF, N1, N2, N3, and N4 are constants used for reading the joystick.

If you'd rather not type in the programs (VIC version only), send a self-addressed stamped envelope, a blank tape, and $3 to:

Don Whitaker
8200 Pennsylvania Way
Thornton, CO 80229

See program listings on page 181.

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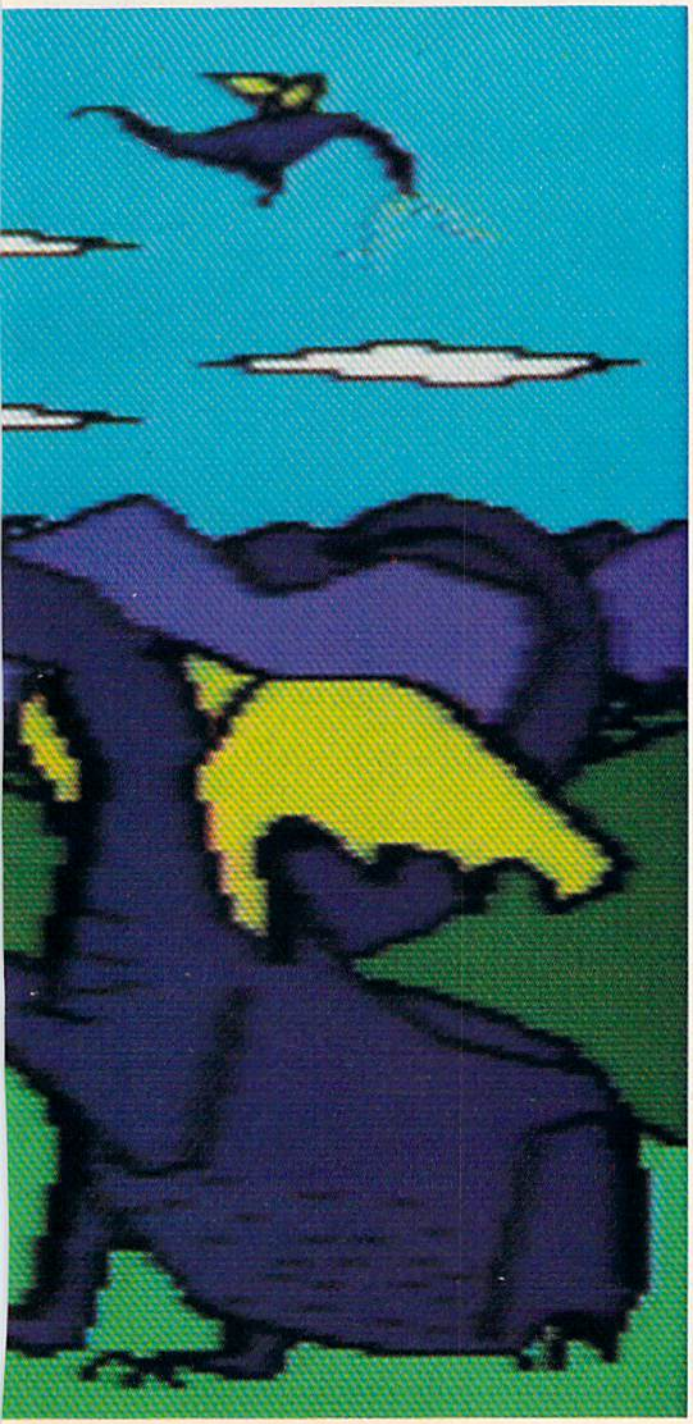
The New King Of The Mountain

Fred D'Ignazio, Associate Editor

My daughter, Catie, was born in December 1975. My son, Eric, came along in April 1979, over three years later. Today Eric is four, and Catie is eight. When I look at Catie, she always looks bigger than I remembered. When I look at Eric, he always looks smaller.

Catie amazes me because she is growing up so fast. Eric amazes me because he is staying little so long.

I don't know how many times I have wished that, somehow, Eric would catch up to Catie. It's not that I wish Eric would physically grow as big as Catie. It's just that I wish he would be as *able* as Catie at lots of different things—things like reading, writing, talking, listening, walking, running, minding his parents, drawing, painting. You name it.



This is a big secret that I'm telling you. I've never even shared it with my wife, Janet.

But I'm not the only one in our family who feels this way. Eric feels this way, too. I can tell just by watching him struggling to keep up with his big sister. No matter what Catie does, Eric is there, too, trying to do it. But he is always a little slower than Catie, a little less able.

That doesn't stop Eric from trying. In fact, I think it makes him try even harder. And it has made him pick up the habit of jumping into any situation, no matter how difficult and complex, with the expression: "I know how to do it. Let *me* do it."

Unfortunately, in most cases Eric *doesn't* know how. But that doesn't stop him from trying.

And it doesn't stop me from admiring him.

Eric makes me think of other four-year-olds, especially four-year-olds with older siblings. They must be a pretty hardy bunch. They are at the bottom of the family totem pole no matter what is going on. They always come in last. Yet they never stop trying. I think that's pretty amazing. I know I couldn't do it. It takes a lot of spunk.

The Great Equalizer

Last week we got a new computer product for our Commodore 64—the KoalaPad from Koala Technologies. The KoalaPad comes with a black plastic stylus (a pencil without a lead) and a software package, *KoalaPainter* from Audio Light, all for $125.

KoalaPainter is a do-it-yourself, create-your-own pictures kit. It is also the great equalizer that has reversed Eric's position in the family. He used to be the least-accomplished artist in the group (with the possible exception of our fat black cat, Mowie). But now he is the best artist in the family (the best *video* artist). He is the king of the mountain. And he's loving his new position.

The Acid Test

The acid test for any new computer product is whether it lets people do something on the computer that either (1) they could not do without the computer, or (2) they could not do as well without the computer.

The KoalaPad and *KoalaPainter* have dramatically passed this test. Eric can do things now on the computer that he could never duplicate on paper. In fact, Eric can do things on the computer that I can't duplicate on paper or the computer. And I'm 34.

For a four-year-old, Eric is a pretty good artist. But, using crayons, magic markers, and paper, he is no match for his big sister or, for that matter,

Janet or me. However, using *KoalaPainter* Eric is more than our match. Eric is now the reigning video-art champ of our family.

When Eric first boots up the *KoalaPainter* disk he sees a bunch of "menu" boxes on the display screen. When he presses the point of the plastic stylus against the KoalaPad, he sees a cross-hairs drawing cursor on the picture screen. By moving the stylus around on the pad, he moves the cursor on the picture screen from box to box.

The boxes let Eric choose the size of his paintbrush, the color of "paint," and the type of drawing he wants to do. Here are some of the boxes that hold Eric's drawing tools. With these tools Eric can:

* DRAW	Draw freehand.
* LINE	Create "rubber band" lines that stretch across the screen.
* LINES	Connect rubber bands, end to end.
* OOPS	Undo his most recent drawing command.
* FRAME	Make rectangular frames.
* BOX	Draw a framed filled in with a particular color.
* RAYS	Draw lines that radiate from a central point.
* XCOLOR	Change one color on the screen to a new color.
* COPY	Copy a picture or portion of a picture onto a new screen location.
* MIRROR	Create mirrored images simultaneously on the picture screen.
* CIRCLE	Draw circles.
* DISC	Draw circles filled with a particular color.
* FILL	Fill in any shape he creates with any color he chooses.
* ZOOM	Magnify a picture for detailed drawing, erasing, or changing.
* SWAP	View two pictures at the same time. Using the COPY command Eric can copy portions of one picture onto the other picture.
* STORAGE	Store his pictures on disk.
* ERASE	Erase the entire drawing area.

This sounds like an overly powerful array of tools for a four-year-old. Don't believe it. They boggle Janet and me, but they do not boggle Eric. He attacks *KoalaPainter* the same way he charges down the street on his Big Wheels bike—ZOOM!

Rough Drafts

Once, a couple of years ago, I had a conversation with Alan Kay, Atari's chief scientist for research and development. Kay is also one of the inventors of Smalltalk.

We were talking about the difference between a novice doing a task and an expert doing the same task. Kay said the key difference was that the novice was happy to do the task once, then go on to something else. The expert, on the other hand, did the task, then did it again and again to do it better. Each time the expert did the task it was like producing a "rough draft" of a writer's manuscript. The expert kept churning out new drafts. Along the way the expert polished, embellished, corrected, adjusted, and fine-tuned the product of his or her labors until it was done right. Then the expert went on to something else.

Why don't novices do rough drafts like experts?

They don't because usually it is too hard. They barely know their craft—of writing, painting, bridge building, cartwheel turning, driving, or whatever—and they usually work with primitive, amateurish tools. The expert, on the other hand, works with the finest tools technology can produce and is competent, disciplined, and experienced in the craft. The mechanical part of the work comes naturally, intuitively, and effortlessly. With the right tools and skill, the expert can reel off several drafts in the time it takes the novice to complete just one.

Computer Elevator Shoes

What happens, though, when you put a tool into a novice's hands that compensates for his lack of experience, his undeveloped motor and cognitive abilities, and his dearth of skill and craft?

KoalaPad's *KoalaPainter* is such a tool, and Eric is such a novice.

When I watch the beautiful pictures that Eric produces on the KoalaPad, it makes me think of a seesaw. Let's say I'm on one side and Eric is on the other. Usually, my greater size and weight makes the seesaw unbalanced. I drop like a stone, and Eric flies up in the air.

With *KoalaPainter* on his side, Eric goes down and I go up. What happened? It seems that *KoalaPainter* is a great equalizer. It amplifies and extends Eric's limited cognitive and motor skills

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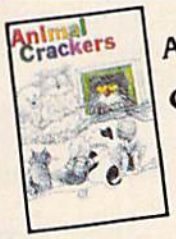

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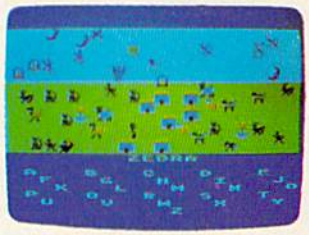

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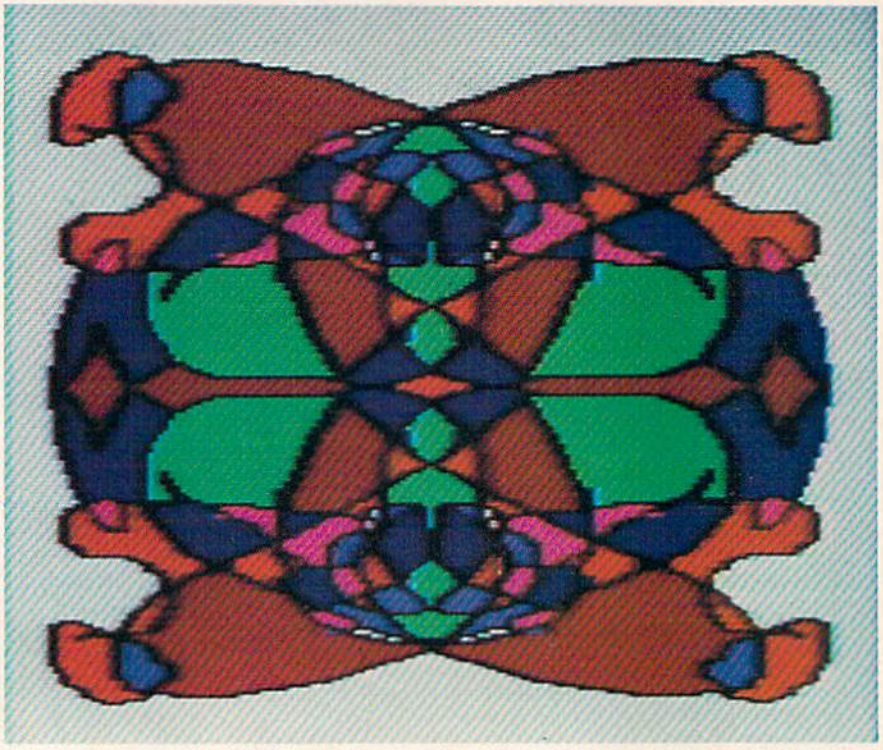

beyond my own. It also taps his unbridled energy and imagination. It harnesses his tremendous curiosity and his tireless capacity for exploration and discovery.

With *KoalaPainter*, Eric does *lots* of rough drafts. And he does them fast!

The Brick Wall

Watching Eric use the KoalaPad and *KoalaPainter* can be sheer delight. It is not sheer delight at all times, however. Eric creates new *KoalaPainter* pictures at 90 miles an hour. Sometimes he takes a wrong turn and runs, SMACK!, into a brick wall.

Not surprisingly, Eric does not like to run into brick walls. So what does he do?

Sometimes when he runs into a wall he backs up and tries a new path. Sometimes he tries climbing over the wall. Sometimes he tries to knock the wall down.

And sometimes he just sits there and howls.

Leonardo The Little

When Eric boots up the *KoalaPainter* disk he sees the menu with all the little pictures of brush sizes, paint colors, and activities. He never pauses to study this menu. Instead he presses the KoalaPad with his stylus, chooses a color, a paintbrush, an activity, and dives right into making a new picture.

I often wonder: Does he think that fast? Or is he in "playground" mode where he races from swings to monkey bars to merry-go-round randomly and at top speed?

In any case, within seconds after turning on the computer, Eric has a new picture under way. And, more often than not, the picture is stupendous.

This is because, to create a picture, Eric has usually employed all the tools that *KoalaPainter* provides. All the tools. It may not be the most efficient way to make the picture, but it's Eric's way.

He uses the CIRCLE command to grow concentric circles of different colors around the screen.

He uses the MIRROR command and the RAYS command to create prickly sea urchins with purple and green spikes.

He uses the MIRROR command and the LINE command to create beautiful, layered tiles of multiple colors.

He uses the COPY command and the ZOOM command to create lots of tiny ERICs inside boxes, triangles, and circles, all over the screen.

He uses the ZOOM command and the BOX command to erase mistakes. The ZOOM command is good for erasing little mistakes. The BOX command is perfect for the great big mistakes.

Electronic Scribble

When Eric draws on a piece of paper on the kitchen table, he often just runs the pencil back and forth across the paper. To Eric this is great fun. To me it looks like scribble.

I think that what Eric is doing on the computer is scribbling, too. He is using the powerful tools made available to him by *KoalaPainter* and the KoalaPad to do advanced (super-advanced) scribbling. This is scribbling at a new plane—*hyper scribbling*.

Maybe the reason Eric is the family champ at video art is that he is also the family's best scribbler. The other family members just can't compete. As Catie grows older, she is losing her ability to scribble. And with Janet and me, it's a lost art.

But Eric is a master scribbler. And, with the Koala tools in his hand, he is also a budding video artist. Maybe these tools will even arrest his development. Maybe he'll keep scribbling forever. And his scribbles will just keep getting more and more complex, and more and more beautiful.

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It teaches me more about my Commodore 64 than any other magazine. Explanatory articles on how programs work. The Gazette is the best magazine for Vic-20 owners. Good writers! Your program listings are outstanding. The Gazette Feedback column. I rate it the best magazine for my needs. The interviews with professional programmers. I'M NEW AT COMPUTING; THE GAZETTE IS VERY HELPFUL. Plain language articles for beginners. It helps me learn the essentials and excitement of computing. The articles on Machine Language. Educational programs in basic. It's not too technical for the average person. The advanced programming techniques. The ads and reviews. ARTICLES ABOUT DISK DRIVES AND MODEMS. The large number of programs. The programming tips and reviews. Information on things the manuals do not explain. Your professional writing; you have very knowledgeable authors. I like learning how computers work. It tells me about current events in the computer industry.

The above comments are from The Editor's Feedback Cards, a monthly part of our continuing dialogue with the readers of COMPUTE!'s GAZETTE.

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COMPUTE!'s GAZETTE

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SPEED READER

Phil Geiser

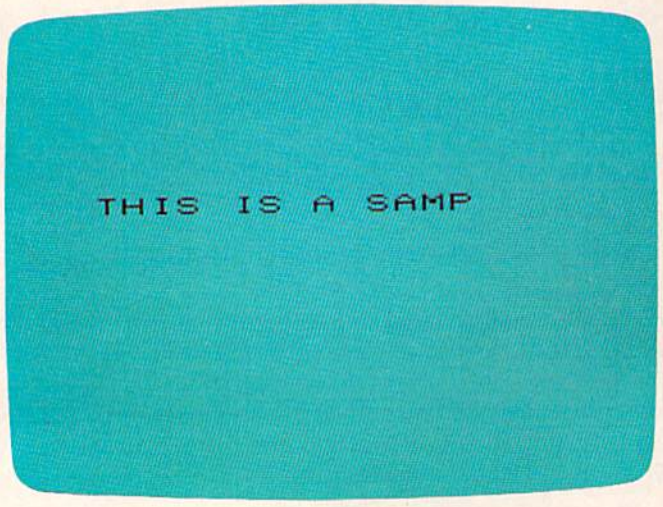
This clever reading-practice program can help increase reading speed when used properly. The program was originally written for the Commodore 64; we've added a version for the unexpanded VIC (memory expansion recommended for longer reading selections).

Everyone knows computers are good at helping us with two of the "Three R's": 'rithmetic and (thanks to word processing) 'ritin'. But what can a computer do to help your readin'?

Reading specialists have known for years that one of the problems of many slow readers is a bad habit called "regression." Simply described, these slow readers spend much of their reading time looking back to earlier words on the line of print or to words earlier in the reading selection. As a matter of fact, most people do this to some extent. Even good readers may regress up to nine or ten times for every hundred words they read.

If the reader can always keep moving ahead in the text, he or she can obviously increase reading speed. Reading teachers at all levels of education use this knowledge to design strategies to teach (force!) the reader to look only to upcoming words. Typically, reading machines display one line of text for a controlled length of time.

Since part of the problem involves training our eyes to move only from left to right, we can gain more speed by teaching ourselves this habit and not looking back to words we have already read. If we could see only a few words at a time moving from left to right, this forced movement would gradually train our eyes to move in a more efficient way. With some practice we can improve our overall reading speed, and it may even be possible to double or triple our speed with dedicated effort.



Sentences scroll by from left to right in "Speed Reader" (VIC version).

Your Computer As A Reading Machine

This program simulates those speed-reading machines which force the reader to view only one line from left to right at a controlled but adjustable reading speed.

Here's how it works. First it sets the screen and background colors as well as a printing color. Variables are initialized, then instructions are displayed. The five options include a faster or slower reading speed and the option to see more or fewer characters on the line at one time. At the start of the program you are reading about 100 words per minute (slow for an adult), and five characters at a time are being displayed.

The program reads the sample text from the first DATA statement and prints that line on the screen in the background color. One entire line (up to 40 characters on the 64 or 22 characters on the VIC) is printed, but it is not visible because it

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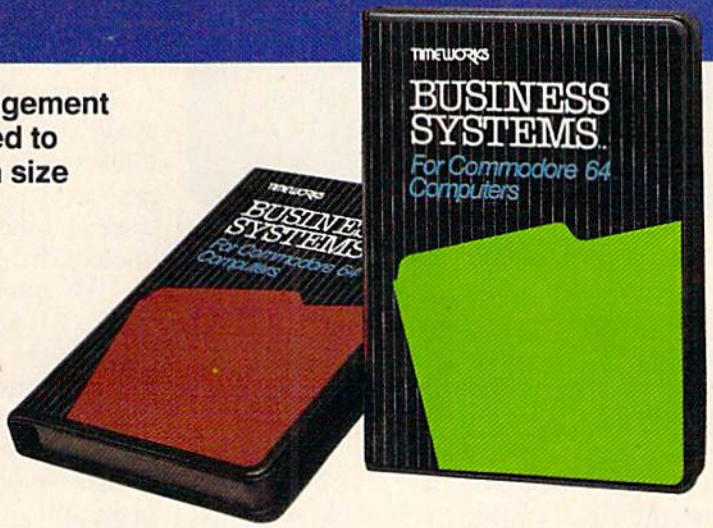

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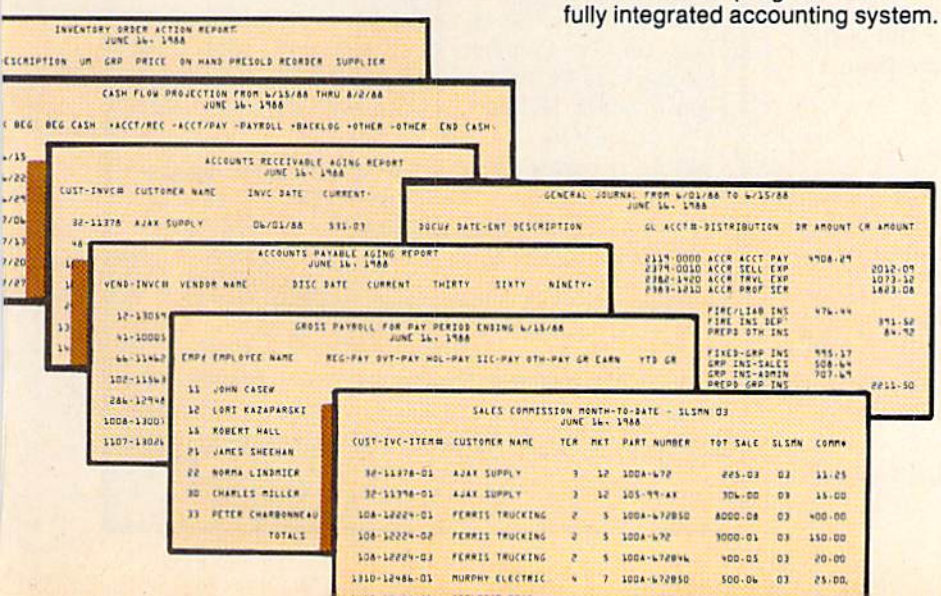
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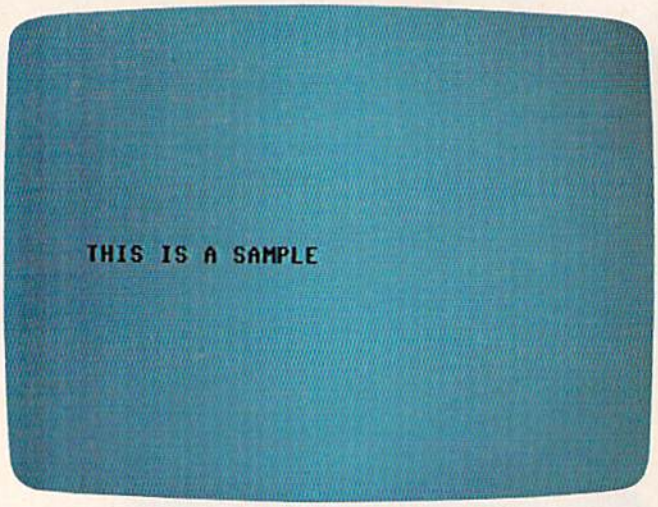

"Speed Reader," Commodore 64 version.

is printed in the same color as the background. Next, a loop POKEs the display colors of the characters already printed on that line so they appear in contrasting colors from left to right. A delay loop slows down this process.

When the left-to-right display loop has reached the rightmost column, the program scans the keyboard to check if a key has been pressed. If so, it changes the speed or the number of characters displayed at one time. Note: A key has to be held down only at the end of a line. It is at this time only that any changes in the display are made. Up to 11 characters may be viewed at one time, or you may select as few as 3 characters at a time. The program then repeats this whole process until all the text is used.

The literary selection displayed on the screen is stored in the DATA statements. The length of each statement cannot exceed 40 characters on the 64 or 22 characters on the VIC (one full screen display line). Virtually anything from a children's story to a scientific article can be typed in as your own DATA statements. The one restriction is quotation marks used in dialogue, etc. Use the single quote (apostrophe) instead.

The short routine at the end resets the computer, stops the program, and stores the final DATA statement.

Modifying The Program

You certainly don't need to be an expert programmer to use this idea to increase your reading speed. All you really have to do is type in a suitable selection in place of the DATA statements in this program. Quite a bit of typing is required to create a reading selection long enough to make this reading practice really beneficial. But such eye training has enabled some readers to make dramatic increases in their reading speed.

Here are some other suggestions and possible modifications:

1. The word DATA can be abbreviated by typing D-SHIFT-A.

2. Since your objective is to attain speed, the reading selection should be easy reading for the intended audience. A selection slightly below that person's reading ability is ideal.

3. The length of the selection should be sufficient to provide five to ten minutes of practice.

4. It is possible to put a five- or ten-question quiz at the end of the program to test for the reader's comprehension of the material.

5. The program can be modified so that the speed gradually increases automatically as the reader goes through the selection. A line such as:

```
205 LK=LK+1:IFLK>10THENLK=0:DD=DD-1
```

speeds the reading display slightly after each ten lines of the selection.

The program is liberally sprinkled with remarks which explain what is happening at that point in the program. To speed up your typing of this program, you need not type in any of the remarks.

I would be interested to hear from any readers who develop unique or creative uses for this program.

Phil Geiser
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Stronghurst, IL 61480

See program listings on page 170.

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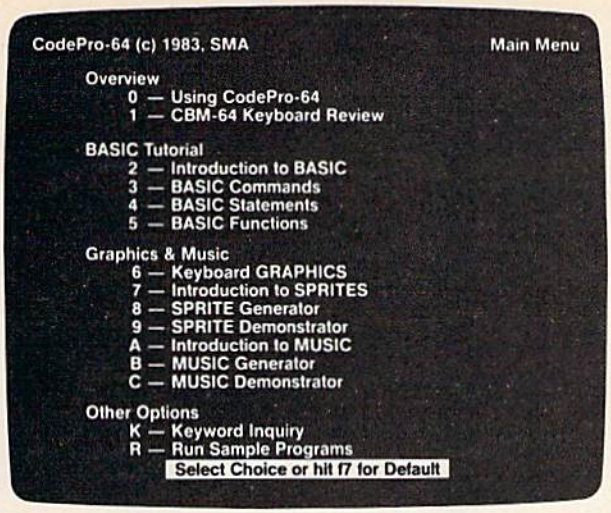

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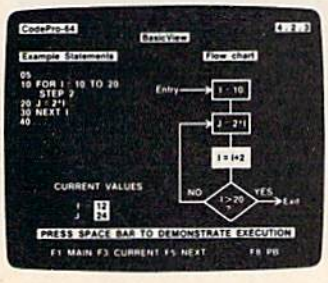
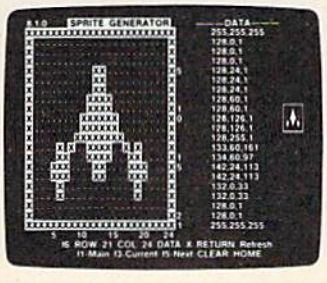
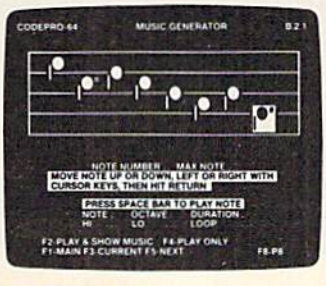
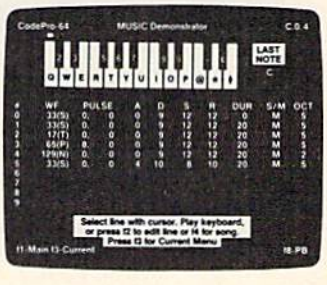




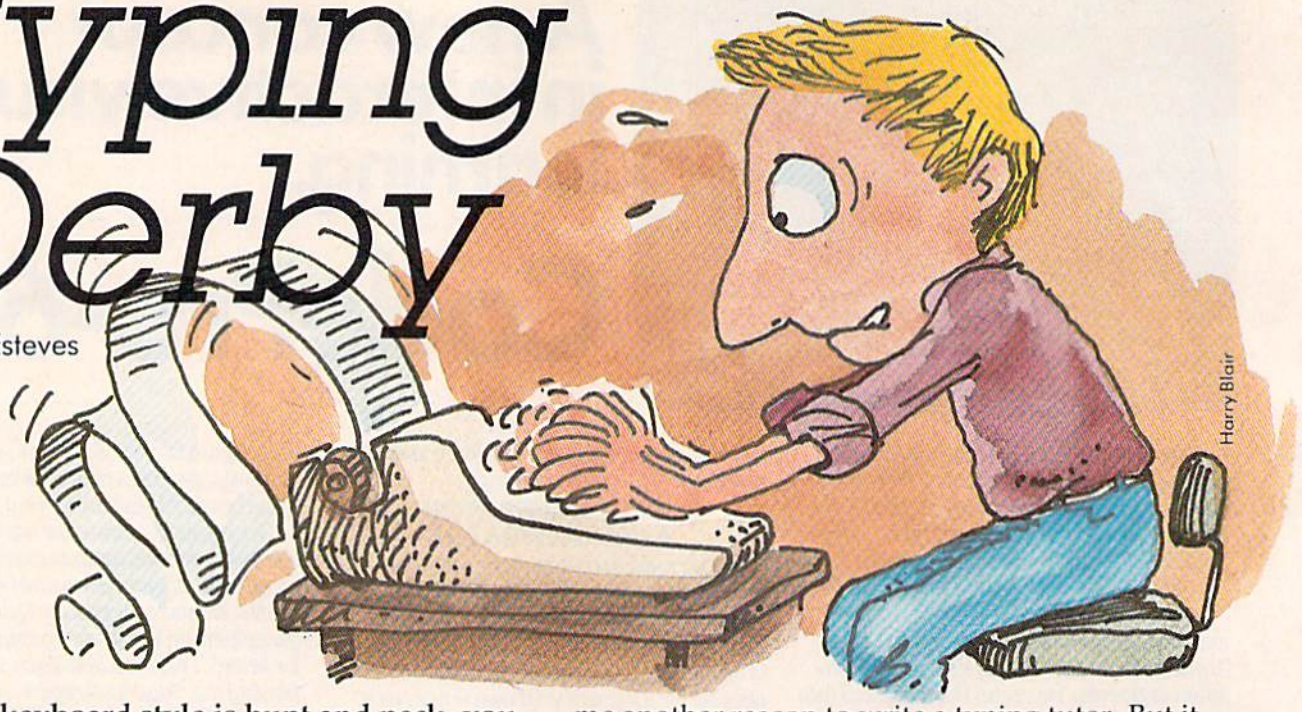




SYSTEMS MANAGEMENT ASSOCIATES

Typing Derby

Carlos Esteves



Harry Blair

If your keyboard style is hunt and peck, you need "Typing Derby." Its repetitive drills can help make you a smooth touch-typist. The original version is for the unexpanded VIC, and we've translated it for the Commodore 64.

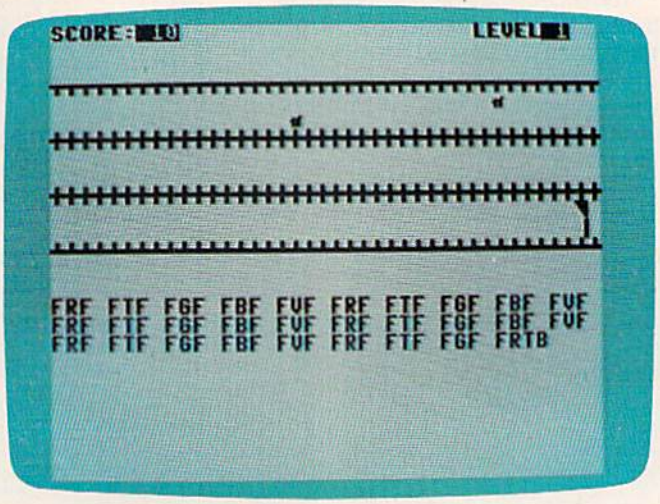
You can acquire lots of good software for very little money by typing in program listings from books and magazines. However, entering a long program at the keyboard can be, for us two-fingered typists, a slow process. So, I decided to enlist the help of the computer to improve my typing. Having three children who are already dealing with the keyboard and who will eventually work with word processors or typewriters gave me another reason to write a typing tutor. But it also called for a program with some game features which would appeal to them and take some of the drudgery out of typing practice. Hence: "Typing Derby."

Racing The Computer

In Typing Derby, players race a red horse against the computer's black horse by correctly typing—without looking at the keyboard—the exercises displayed at the bottom of the screen. Each finger is assigned a range of keys. There are 13 levels of difficulty. When you have won against the black horse 23 times, earning 230 points, you move up to the next level.

At first the pace is slow, allowing each finger to get the feel of the keys in its range. But every

Outracing the computer in the VIC version of "Typing Derby."


SCORE: 10 LEVEL 1
FRF FTF FGF FBF FVF FRF FTF FGF FBF FVF
FRF FTF FGF FBF FVF FRF FTF FGF FBF FVF
FRF FTF FGF FBF FVF FRF FTF FGF FRTB

The right index finger is getting a real workout in this game of "Typing Derby" on the Commodore 64.

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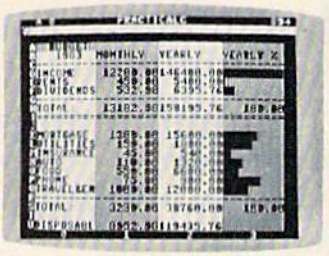

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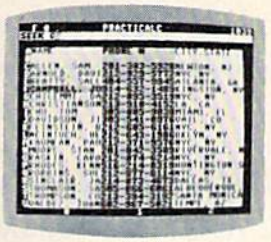

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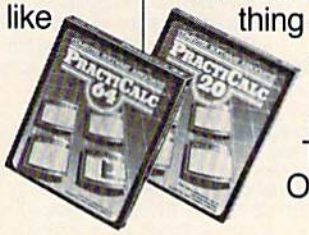

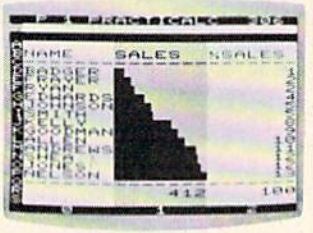

Alpha or numeric sort...

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time your red horse wins, the black horse runs faster in the next race. While it is possible to type faster, make mistakes, and still win handily, it is better to win a close race with no mistakes. At the end of each level you will need the typing speed but cannot afford the mistakes.

Brief Program Description

The program is simple enough, but takes just about all the memory available in an unexpanded VIC-20.

Lines 2-21 contain initialization, opening, and closing routines.

Lines 22-80 set the screen for the beginning of each race, including the "call to the gate" and the text of the corresponding exercise. (The horses and their colors are POKEd while everything else, except colons and commas, is PRINTed).

Lines 90-170 control the development of the race.

Lines 200-290 are DATA statements. Each line corresponds to a level of difficulty and contains the text of the exercise.

Lines 300-390 are the sound subroutine.

Lines 401-432 are instructions.

The choice of the number of points required to move on to the next level (230) is, of course, arbitrary. Since the purpose of Typing Derby is to practice at the keyboard, it does not seem excessive to me. However, this can be changed by adding or subtracting from 220 in line 21, and by adjusting the value of R (lines 10 and 21), which controls the speed of the black horse. (The 64 version lets you enter an initial value for R.)

Finally, the number of exercises is limited only by the size of memory. Any book on touch-typing could provide exercises. Just remember that colons and commas cannot be part of items in the DATA statements. They have to be POKEd directly into screen memory (e.g., lines 52–55).

See program listings on page 176.

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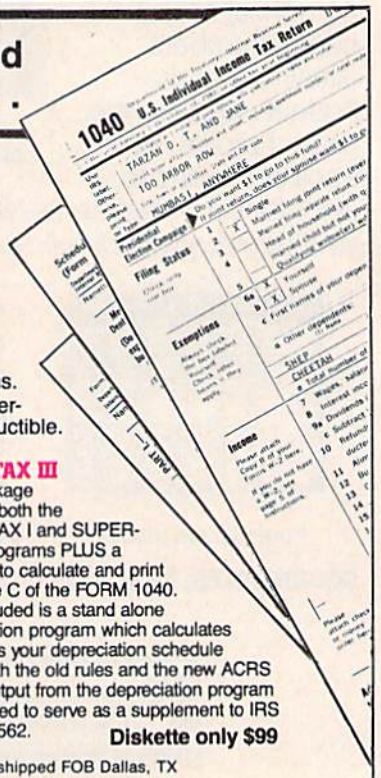

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Fred Hambrecht

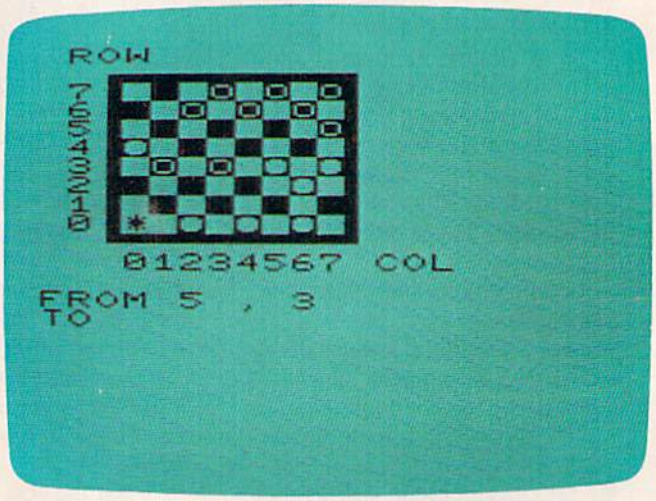
In "Checkers," you match wits with an opponent who rarely makes mistakes: your computer. For the unexpanded VIC and 64.

This computer version of "Checkers" plays just like the traditional game: The same movement rules apply; you can double- (or even triple-) jump, and you can make kings. It is written to run on the VIC (no memory expansion required) and the Commodore 64. Because it uses most of the memory on an unexpanded VIC, screen instructions are not included. If you have a 64 or a VIC with expanded memory, there is plenty of room to add instructions at the beginning of the program if you wish.

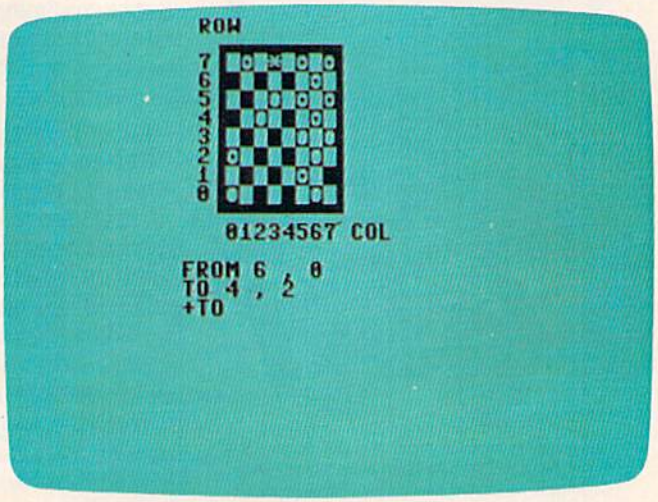
The computer always makes the first move. When it's your turn, decide on the checker you want to move, then identify it first by column, then row. These are labeled next to the checkerboard. Be sure to enter the column number first, then the row number. Don't press RETURN. Before taking its turn, the program automatically moves your checker for you. If you make an illegal move, the program ignores it and waits for a new entry.

To jump a computer's checker, you must press RETURN after entering the coordinates. In the case of a double jump, enter the second set of coordinates after the prompt "+TO", then press RETURN. For a triple jump, enter three sets of coordinates, etc.

You'll find that the computer plays a conservative game, but what it lacks in strategic imagination it makes up for by making few careless



A king is created in the VIC version of "Checkers."



Preparing for a double jump in the 64 version.

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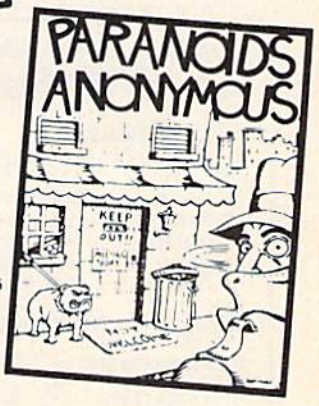

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errors. Also, it does not require you to jump the opponent's checker, and it takes advantage of this tactic.

You'll have to play within the rules for Checkers. You'll find you can cheat the computer by jumping your own checker or by moving backwards. Because the program is written to fit in both the unexpanded VIC and the 64, it is as concise as possible. There are only about 100 bytes free in the VIC, which is not enough room to program the necessary checks for every possible illegal move.

Also, if you lose to the computer (you probably won't), there is no routine that sends you back to the start. Just reLOAD and RUN if you want to play another game.

Note To 64-Users

Because the program was originally written for display on the 22-column screen of the VIC, the checkerboard will not be centered on the 64's 40-column screen. If you would prefer a centered screen display, type in the screen formatter program discussed in "Homonym Practice," elsewhere in this issue. This program adjusts the 64's 40-column screen to simulate a 22-column VIC screen. Just type in the screen formatter program and RUN, then LOAD and RUN Checkers.

See program listing on page 173.

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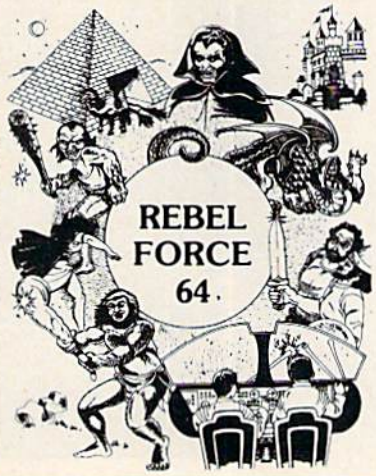

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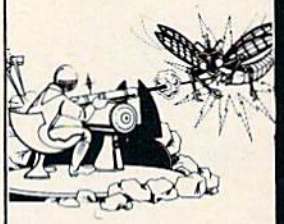

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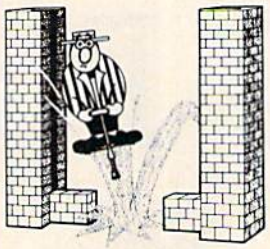

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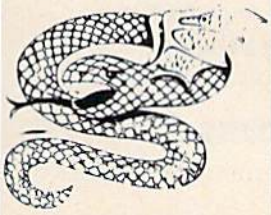

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VIC Piano

Brad Bascom

The VIC has three voices that can play music. Just calculate the number to POKE, set up the durations, and turn the sound on and off. It works beautifully.

But it's programming, not *playing*. What if you want to sit down at the computer and plink out melodies, the way you can with a piano or organ? Typing something like POKE 36876,207 for each separate note isn't exactly recreational music.

Easy Melodies

"VIC Piano" lets you use the top two rows of your keyboard as if they were the keys on the piano. Just type in the program, SAVE it to disk or tape, and type RUN.

You'll see nearly two octaves of a piano keyboard, from G to E, with white and black keys. Below the piano keys are listed the VIC keys to press to play that note. Perhaps more helpful, however, is the white dot that appears directly under the picture of the key that was last pressed. It follows along as fast as you can play, so that very quickly you can pick out melodies without looking down at the VIC keyboard at all.

When you play a note, it will continue to sound until you play the next note. If you want a musical rest, or silence, press any key that does *not* represent a note. The dot will jump to the lower-left corner of the screen and the sound will stop until you press another note.

Sometimes, if you play *very* quickly, you'll get ahead of the program. The keyboard buffer will come to your aid—the VIC can keep track of up to ten notes at a time. You'll find it's pretty hard to play fast enough to use up that buffer.

You may notice that some of the pitches aren't exactly perfect. This can't be helped, unfortunately, since the numbers the VIC understands aren't the regular musical scale. Instead, the VIC understands numbers that represent sound frequencies, and the numbering system does not always have an exact equivalent to the musical scale. So don't tune your piano to your VIC!

How The Program Works

For each key you press, VIC Piano must decide several things:

1. Does this key represent a valid note?
2. Where on the screen should the dot be

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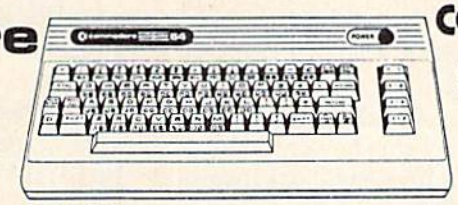
VIC-20 CALL



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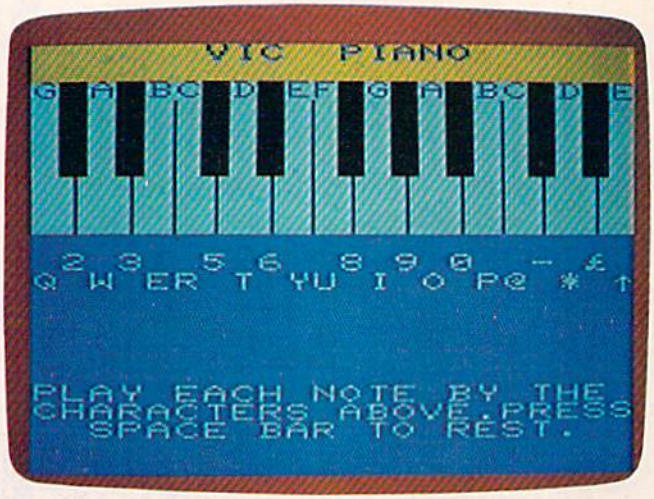
placed, showing which note is being played?

3. What frequency number should be POKEd into the sound register at 36876?

This can be quite complicated, and if the program had to test each time for every possible note, it would run very slowly. Fortunately, by careful design the program can be made to run very, very quickly, even in BASIC.

How? The placement of the dot is easiest. The piano keys are displayed on the screen so that each of the 22 notes can be clearly represented by a character on the VIC's 22-character line. So all we need to do is determine the starting address of the row just under the piano keys. In the unexpanded VIC, the address is 7900. Each key pressed will cause the dot to be displayed at 7900 plus the left-to-right order of that note. G, the lowest note, is 0, so that the dot character (screen code 81) will



"VIC Piano" turns the computer keyboard into a musical instrument.

be POKEd into 7900+0. The highest note, high E, is in the 21st column, so that when high E is played the dot character is POKEd into 7900+21.

Slightly harder is the calculation of the frequency to be played. For instance, the notes G, G#, A, and A# have POKE values of 175, 179, 183, and 187. So far, all the notes are four steps apart. But high C#, D, D#, and E have values of 227, 228, 229, and 231. There's no regular mathematical relationship between the notes' order and their POKE values.

The answer is to use arrays for both values. The screen offsets from 0 to 21 are the array J(n). The sound POKE values from 175 to 231 are the array N(n). They both occur in exactly the same order, so that when the note N(x) is played, the dot will be displayed at 7900+J(x); when the note N(y) is played, the dot will be displayed at 7900+J(y).

What will be the index into the arrays? The value of the key the user presses. That way we won't have to use IF statements to set the sound and screen POKE values—we just use the arrays J(n) and N(n), with the keypress as the index n. It couldn't be faster in BASIC.

We'll get the ASCII character of the key pressed with the statement GET A$. Each ASCII character has a numeric value, which we find using the function ASC(A$). If the key pressed was Q, for instance, the value of ASC(A$) would be 81; if W is pressed, the value of ASC(A$) would be 87.

Using this system, the lowest value of A$ that would play a note is 42, and the highest is 94. Since values lower than 42 and higher than 94 can never play a note, we can simply leave them out of the array. Let's DIMension both arrays like this: DIM J(55),N(55). Then, when we GET A$, we'll say X=ASC(A$)−42. This means that if the * (asterisk) key (42) is pressed, X will equal 0, and if the UP-ARROW key (94) is pressed, X will equal 52.

That's just what the program does. In line 160, the program DIMs N(55),J(55). Then in line 180, it READs the values of the arrays. Each pair of numbers in the DATA statements starting at 800 represents the ASC value of a key and the sound register POKE value for the corresponding note. The number for the dot to appear in is in the same order, a number from 0 to 21, so the loop FOR I=0 TO 21 gives us the right values for the screen POKEs. In one pass through the loop, we have given every valid note an ASC value (the subscript or index number), a sound POKE value—N(n)—and a screen POKE value—J(n).

What about the leftover values of N(n) and J(n), all the possible values in between each note? Line 170 puts 0 in every element of N(n) and 264 in every element of J(n). By default, every possible key value will have the effect of the space bar—a musical rest, a stop in the sound. Then, when the note values are initialized in line 180, all the elements that are not valid notes will be rests.

Because of all this setup, initialization takes a few seconds. However, the extra time spent in setting up makes the program itself run very quickly. The main loop is from 400 to 480, only eight short lines. Line 400 GETs the value of A$. If no key is pressed (A$=""), the line keeps looping back on itself until a key *is* pressed.

Lines 10 to 190 set up the screen and initialize the arrays and variables. Lines 800 to 830 are the DATA statements. Each pair of numbers is an ASCII value and its corresponding sound POKE value. (The true ASCII values are in the DATA statements, instead of the ASCII value minus 42, so it will be easier to see which character is paired with each sound POKE value.)

See program listing on page 172.

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Cassette Cataloger

Kevin Gough

If you're using tape storage, by now you probably know how fast those cassettes seem to multiply. Pretty soon it's almost impossible to remember which program is on which tape. "Cassette Cataloger" will help organize your tape library. It works on the Commodore 64 or unexpanded VIC-20 (Commodore 1515/1525 printer optional).

How would you like a listing of all the programs on your cassettes? A catalog that tells you the location of each file according to the tape counter, and how many bytes long the file is. All this, and without much effort on your part. "Cassette Cataloger" will do it!

This program will work in any size VIC-20 and the Commodore 64. Carefully enter the BASIC program and then save a copy or two.

Creating A Catalog

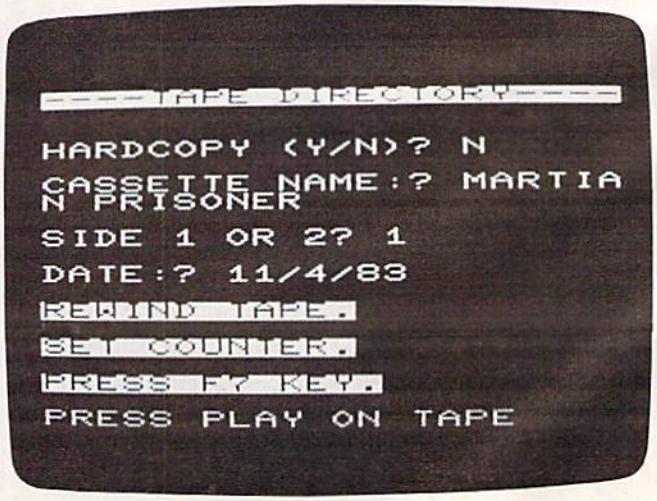
When you first run the program, you're prompted with HARDCOPY? If you have a Commodore 1515 or 1525 printer you can print the catalog.

Other prompts will follow. PRINTER ON? Press RETURN. CASSETTE NAME:? Enter a name for your cassette. SIDE 1 OR 2? Enter 1 or 2. DATE:? Enter the date. (Do not use commas in the date.)

Now the screen says, REWIND TAPE. SET COUNTER. PRESS f7 KEY. Make sure the tape counter reads 000. Press f7 and you are prompted to press PLAY on tape. Moments later, the catalog starts appearing on the screen and/or printer. The tape counter location prompt appears—COUNTER? You must look at the tape counter and enter its number. (The tape is stopped during this input so you have time to read the counter and enter its value.) The tape starts moving again and the catalog continues to appear. Every time the tape stops, you are requested to enter the counter number. If you are careful, you can even do this with your TV or monitor turned off.

If the counter value is stopped somewhere between two numbers, enter the one that is most visible. If it is exactly in between, use the lowest of the numbers. For example, if the count is exactly between 019 and 020, enter 19 for the counter prompt.

To stop the catalog process, press the back-



Compiling directories of all your tapes is easy with "Cassette Cataloger" (VIC version; 64 version similar).

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arrow (←) key at the counter prompt. The process automatically stops at the end of the tape. If the last program on your cassette is far from the end of the tape, you can save time by pressing STOP on the Datassette and then the RUN/STOP key on the computer. The break message appears. Now type GOTO 700 and press RETURN. This should be done only if you know that the tape remaining has no more programs.

After the catalog is created, the computer begins executing the program at line 700. The tape input/output status is displayed and you are prompted with DISPLAY Y/N/H? Pressing RETURN or entering Y will display the catalog. This is helpful if you do not have a printer. Simply copy the catalog on a piece of paper. Pressing N will end the program. H will print the catalog on the printer. Make sure the printer is on.

Note: The Cataloger will not categorize data files; it will just by-pass them.

How The Cataloger Works

VERIFY is the key. Line 10 POKEs a short machine language program into memory starting at memory address 707. The SYS 707 in line 110 calls the program. The program uses Kernal routines that cause a tape VERIFY. The screen prompts you to "Press Play On Tape." The program on tape is compared to the one in the computer's memory—a function we are not concerned with. All we want is the tape to stop moving at the end of each program. That's where the next program begins. This is explained in the VIC and 64 user guides and reference manuals under the VERIFY command. The VERIFY must be done in machine language so that a VERIFY error message does not appear on the screen and stop the program.

The Cataloger learns the length of each program on tape by PEEKing memory addresses 829 through 832—the cassette buffer area. The filename is PEEKed from 833 to 848.

With a listing of all the programs on your cassettes, and where they are located, it will be much easier to find a program you want. Just rewind the tape and set the counter to 000. Now look at the cassette catalog and find the counter location for the desired program. Suppose the program name is "WORD PROCESSOR" and its location is 049. Just Fast Forward the tape to 048 and begin the load. Why 048 instead of 049? To assure that your tape is cued before the program.

If you have any suggestions for improvement, please let me know. I hope you find Cassette Cataloger useful.

Kevin Gough
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See program listing on page 179.

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Homonym Practice

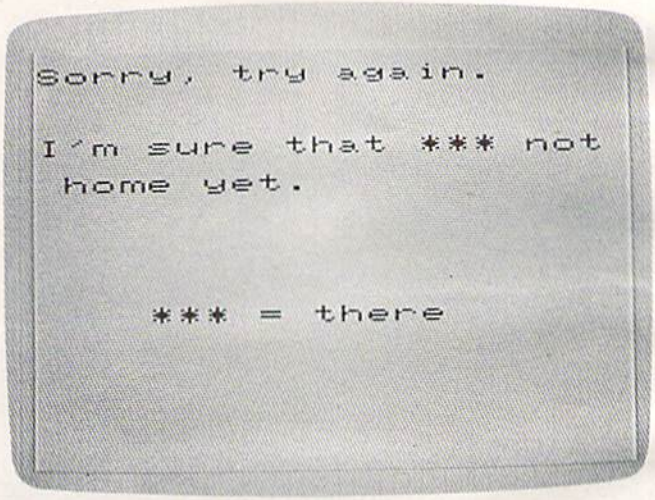
Michael A. Tyborski

This educational program, designed by a schoolteacher, drills young people on the use of homonyms. It works on both the unexpanded VIC-20 and Commodore 64.

My VIC-20 computer supports my teaching in a crowded fifth-grade classroom. It provides daily practice of language and math skills.

I load the computer in the morning and let students practice throughout the day. Since I am busy teaching, I need programs that do not require teacher assistance. To meet this need, I have developed "Homonym Practice" and other educational programs.

Homonym Practice drills students on the homonyms "to, two, too" and "there, their, they're." It also shows some of the features that enhance these types of programs. A standard format allows students to easily work with any one of a series of such programs I have written.



"Homonym Practice" was designed by a schoolteacher for the VIC-20.

Friendly Features

Push-button reset is the most important feature. It involves checking the f1 special function key whenever the keyboard is read. If pressed, the program restarts for the next student. This allows many students to use the program without supervision.

In addition, function key f3 turns the program into a learning guide. It recalls examples of properly used homonyms. This is done in the subroutine at line 42. The student can press RETURN to continue the drill. For this type of lesson, the student must type in the correct answer. This helps the student learn spelling.

Unfortunately, typing is an error-prone activity. This made it necessary to use the simulated INPUT routine at lines 29 to 35. It uses the GET statement to ignore unwanted keys. This prevents data-entry errors from stopping the program. It even allows apostrophes to be typed without the SHIFT key.

The name entry routine at lines 2 to 9 also uses the GET statement. It capitalizes the student's name even if the SHIFT key was not used.

Lines 10 through 20 display directions in a series of frames. This increases readability. Although more memory is used, the trade-off is definitely worth it. Subroutine 51 holds the text until the student presses a key.

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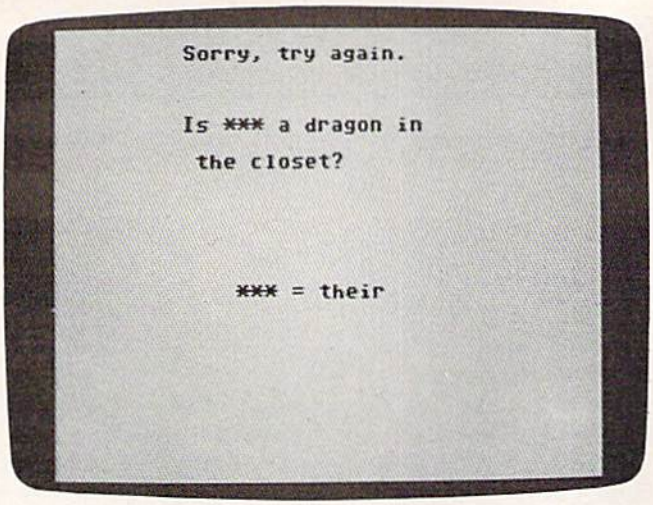

The VIC version of "Homonym Practice" also works on the Commodore 64 with a special screen-formatter program.

Random, But Not Repetitious

It is not easy to fit this program into an unexpanded VIC. (Be sure not to type any extra spaces, or you may run out of memory.) In this case, you can fit only 16 sentences for each set of homonyms. Although this is a reasonable drill, it complicates problem selection.

The first version of the program used random selection. Unfortunately, many repeats occurred. The present method provides better results. It starts at a random point in the list and walks through it in a read-two-sentences-skip-one pattern. This assures no repeats in a lesson and few repeats in any two consecutive lessons.

These features have made Homonym Practice an effective classroom aid. Interestingly, developing drill variety proved to be the most difficult problem. The effort, however, paid off when I watched my students practice much-needed skills.

Commodore 64 Notes

The same program (Program 1) works on both the VIC-20 and Commodore 64. However, because the VIC has a 22-column screen and the Commodore 64 has 40 columns, ordinarily the screen formatting would appear messed up on the 64.

To avoid this, Commodore 64 users should type in Program 2. This is a 22-column screen formatter for the 64 that emulates the VIC screen. It centers the image for an attractive display and automatically handles line wraparound. VIC users should not type in Program 2.

This screen formatter first appeared in the November 1983 issue of COMPUTE!'s GAZETTE with the text-adventure game "Martian Prisoner." If you typed in the formatter for Martian Prisoner, you needn't type it again for Homonym Practice. It's the same program. It creates a machine language program which forces the 64 to PRINT within 22 columns.

SAVE Program 2 before running it for the first time. When you type RUN, it activates itself. If you ever need to reactivate it (after pressing RUN/STOP-RESTORE, for instance), enter SYS 828.

The correct procedure is to first LOAD the screen formatter, RUN it, type NEW, and then enter the main program. You may have success using the screen formatter to adapt other VIC programs to your Commodore 64, too.

See program listings on page 180.

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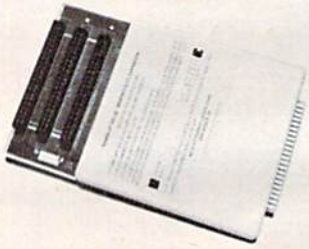

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I put auto-dial to work right away. I auto-dialed Compuserve, but couldn't get through, so I had VIP Terminal redial 'til it got through - it dialed five minutes straight! Then I auto-logged on with one of my 20 programmed keys, and downloaded some graphics screens, and stock quotes for dad. I printed it and saved it to disk as it came on the screen. Wow! And now I can send you my programs automatically. I got yours and they worked right off.

Those icons, - you know, like the Apple Lisa - are a lot of fun. I also like the menus, function keys, highlights, help tables - great for a newcomer like me. And with the many options there isn't a computer I can't talk to.

What's really neat is that Softlaw has a whole VIP Library of interactive programs, including a word processor, spreadsheet and database, which will be out soon. Sis promised me the whole set for my birthday.

I see by the built-in "old clock" on the screen that long-distance rates are down. Got to call that L.A. B B S. Yep, there goes the alarm. Later.

- Lore

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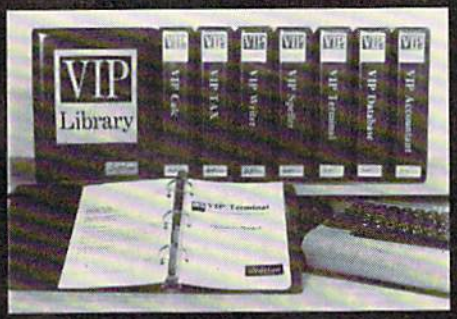

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REVIEWS

Fourth Encounter For VIC

Tony Roberts, Assistant Managing Editor

Destroy successive waves of hostile aliens.

This instruction, taken from the manual accompanying Thorn EMI Video's *Fourth Encounter* game cartridge, tells you nearly everything you need to know to play the game.

What it doesn't tell you is that this is one space shoot-em-up that plays into the hands of less-experienced game players. *Fourth Encounter* gives the player the advantage of being able to play and practice any of the game's phases and skill levels.

Those who suffer the frustration of never having seen a game's most difficult level won't have that problem here.

The Game: A Quick Look

In *Fourth Encounter*, the player, piloting a yellow spaceship, faces four enemies. Let's call them the Bees, the Moths, the Clones, and the Rays. You take on these evil aliens one by one. If you manage to defend your planet against each of these four attackers, you move to the next skill level and face them all again. This time, however, the aliens are a little faster, and much more heavily armed.

As you play against the Bees, Moths, or Clones, your ship is anchored to the bottom of the screen. It can move only horizontally to defend against the attacks, most of which come from above. When fighting the Rays, however, your ship can move anywhere to defend against the attacks that come from everywhere.

You have five ships allotted to you per game. Each time one is destroyed, you must endure several seconds of a sound effect similar to a machine gun blast. You receive an additional ship for every 10,000 points you score.

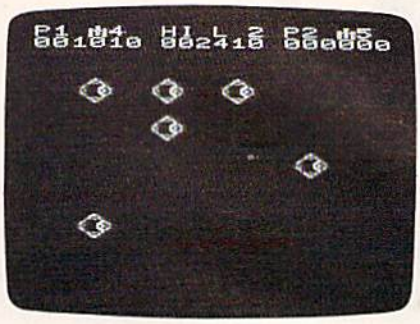
The game is set up to accommodate either one player or two players taking turns. The high score is always posted as an incentive.

The Opposition: A Scouting Report

The first problem you face in *Fourth Encounter* is a swarm of red and yellow aliens. Somewhat beelike in appearance, these aliens drop from above. You must shoot them before they crash into your ship. There are 60 aliens in this swarm, and they'll keep attacking until you've wiped them all out.

During the game's first level, the Bees can do nothing but attempt to crash into you. In levels two and three, however, the Bees augment their attack with dozens of colored bombs that rain down upon you.

The next wave of aliens are rather like electrically charged moths. They flit about the night sky, and they can knock your ship out either by crashing into it or dropping bombs onto it. These Moths move in a sort of circular motion. But, beware—just because one has moved off the bottom of the screen doesn't mean it's gone. It may rise up from nowhere, crashing into the bottom of your craft.



Mothlike aliens descend and drop bombs on the player's ship in Fourth Encounter.

Dispense with the Moths and you face the Clones—exact copies of your ship. These aliens, however, carry an arsenal of colored bombs and sophisticated radar systems. The attack force seems to dance in the sky, each ship taking a turn using you for target practice. The Clones themselves, however, make very difficult targets. They seem to sense your shots as they dance out of harm's way. At upper levels of the game, their evasive maneuvers are more agile, and their fire power is more awesome.

The final opponent, the Rays, presents an entirely different problem. In this test, your ship is free to roam—or rather run—about the entire screen. The Rays attempt to eliminate you with a sort of ray gun. To survive this round, you must dodge the Rays which crisscross the screen, and destroy the alien bases which move quickly about the perimeter of the screen.

The Battle: Your Choice

Before play begins, you are presented with a menu of options that allows you to select the number of players, the level of

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difficulty, and the phase of the game you wish to play.

With these options, you can play the game in a traditional fashion, moving from one opponent to the next and from one level to the next. Alternatively, you can practice parts of the game that give you trouble, or avoid parts of the game that you've outgrown.

In each phase of the game, you must eliminate a fixed number of aliens before moving on. In the early moments of an attack, the screen will be filled with targets, and most of your shots will hit something. Once the attackers' numbers have dwindled, however, marksmanship becomes much more important.

Fourth Encounter plays very well on the VIC. It is fast, smooth, and colorful. The game includes an interesting visual treat that is repeated each time a ship is destroyed or each time you move to a new level. The scoreboard, which normally occupies the top lines of the screen, collapses into a small block in the center of the screen, almost as if it has become the victim of a black hole. Then the process reverses and the updated scoreboard is restored.

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Suspended For Commodore 64

Dan Carmichael
Submissions Editor

In the world of text adventure games, Infocom has long been one of the leaders. In 1979, its programmers started writing their own language which enabled the adventure game player to communicate with the program using complex sentences instead of the usual one- or two-word commands. Ever since 1980, when Infocom marketed its first commercial success (*Zork I*), Infocom's games have almost always been on the various software best-seller lists.

One of Infocom's latest releases, *Suspended*, is no exception to the rule. It is an exciting, imaginative adventure game that's likely to keep you glued to your keyboard for hours.

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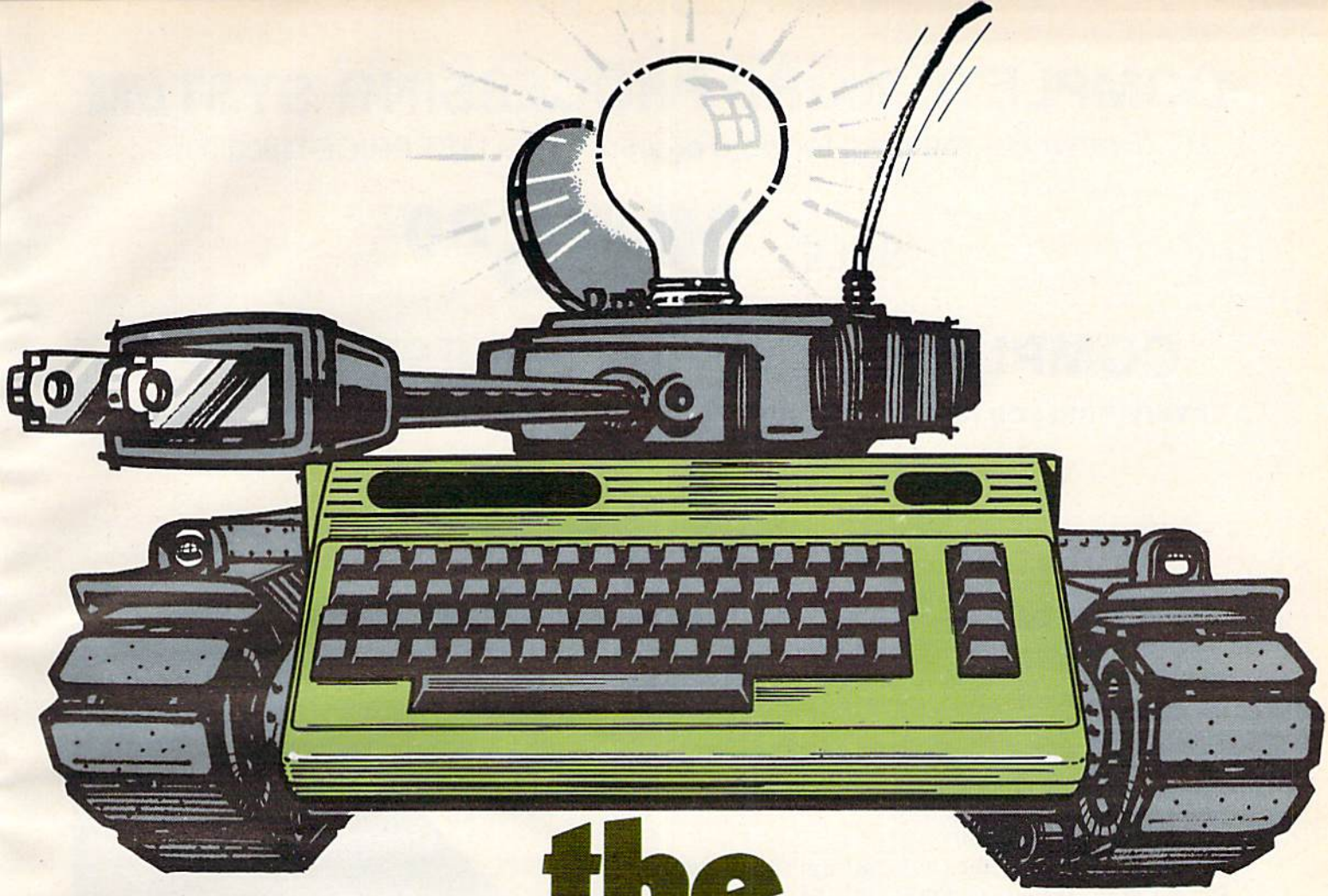

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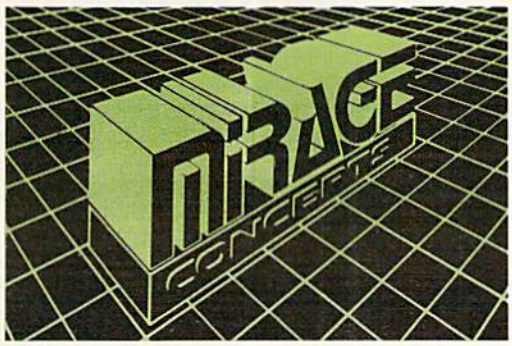

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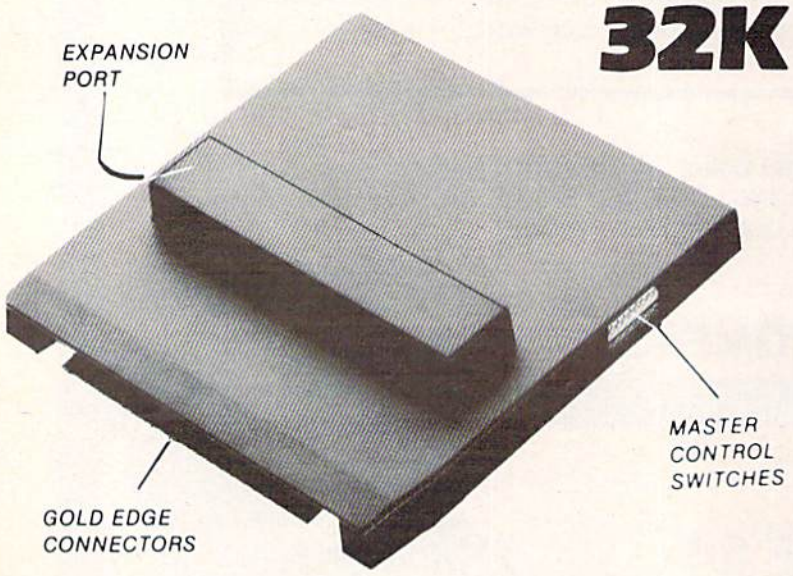

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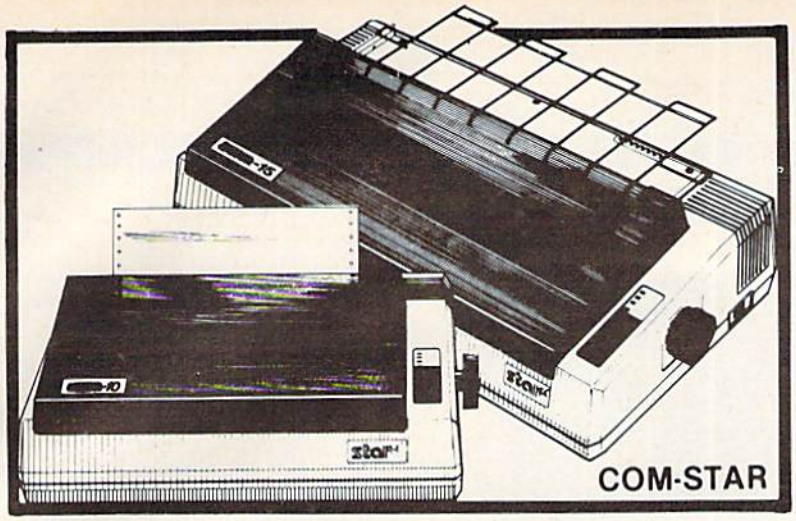

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robots and computers. While the human species continues to live on the surface of the planet, the robots move about in a huge underground complex controlling all the computers and machinery that is necessary to sustain life on the surface of the planet. However, the underground complex is not completely automatic, and that's where you come in.

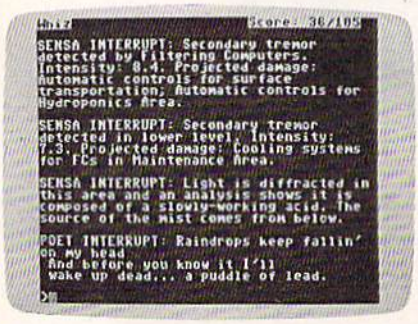
In the game, you have been chosen as the winner of the semi-millennial lottery, and an honor it is. As such, you will serve as Contra's Central Mentality for the next 500 years. This is a position of immense responsibility because you must insure the survival of all life on the surface of the planet.

You will be placed in a state of suspended animation, and your brain will be used to control the Filter Computers, which control all systems on the planet surface.

Computers And Robots

To help you manage the huge underground complex and all its machinery, you are given the use of six robots. You communicate with the robots through the Filter Computers. The robots are individual personalities and each possesses unique qualities and talents.

The six robots are Iris, Waldo, Sensa, Auda, Whiz, and Poet. Iris is a visual robot, the only one capable of seeing. Waldo is your heavy-duty robot. He is capable of carrying many heavy objects and is able to perform tasks ranging from heavy equipment repairs to delicate microsurgery. Sensa has a mixture of different sensory apparatus. She can detect such things as vibrations in the underground


Whiz
Score: 38/105
SENSA INTERRUPT: Secondary tremor detected by Filtering Computers. Intensity: 8.4. Projected damage: Automatic controls for surface transportation; Automatic controls for Hydroponics Area.
SENSA INTERRUPT: Secondary tremor detected in lower level. Intensity: 7.3. Projected damage: Cooling systems for FCs in Maintenance Area.
SENSA INTERRUPT: Light is diffracted in this area and an analysis shows it is composed of a slowly-working acid. The source of the mist comes from below.
POET INTERRUPT: Raindrops keep fallin' on my head
And before you know it I'll
wake up dead... a puddle of lead.
>W

Poet's messages mystify with rhyme, but can be very revealing in Suspended.

complex, photon emission sources, and ionic discharges. Auda is all ears, the only robot capable of hearing. Whiz is the brilliant one. He is used as an interface to the four computers that are the main sources of information about the complex. Poet is the unusual one. He talks to you in rhyme. His messages are sometimes hard to figure out, but very informative once you understand his style. He is also a diagnostic robot with a highly developed sense of touch.

The four computers that Whiz operates (called *peripherals*) are an important key to the game. They are the Index, Technical, Advisory, and Historical Computers. By using Whiz, you can gain information ranging from the technical aspects of any object found in the complex to the history of various subjects. The Advisory Computer might even give you some advice on how to accomplish the task you're currently working on.

Playing The Game

The Filter Computers control the surface systems such as weather control, food production, and all surface transportation. When the game is first started, the Filter Computers have just begun to break down, and a major world catastrophe is in the making. The weather system is in error, and major storms on the planet's surface are killing the human population. The food-producing system (deep underground hydroponic farms) has gone awry and crops are dying. Without food, the population will starve. And the transportation system has become chaotic. The Floaters, Taxis, and Glide Ramps (forms of mass transit) are running uncontrolled and are killing people by the hundreds of thousands.

Your job as central controller is to repair the Filter Computers and reset all the surface systems to normal operation. You must use your robots, and you encounter a number of extra surprises along the way.

A Busy Program

While *Suspended* is enjoyable and stretches your imagination to its limits, the great complexity of the program itself does result in one minor drawback: occasional slow response. Because the program in *Suspended* has to keep track of six characters, the response time can be somewhat slow. Infocom's special language enables you not only to communicate with the robots using complex sentences, but also to issue multiple commands in one statement. Some commands require as long as two or more minutes for a response. This is to be expected in a "thinking" game as complex as *Suspended*—many computer chess programs take hours to ponder their moves.

If the small inconvenience of a sometimes slow response does not bother you, then I can highly recommend *Suspended*.

Suspended
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Despite the wild claims made by the Blackjack system charlatans, it is not possible to learn an effective strategy overnight. Learning an effective strategy takes time and discipline. If learning a strategy were easy, everyone would be making a living playing Blackjack. As it stands, less than one percent play well enough to make money.

The Solution

BLACKJACK TEACHER simulates, in precise detail, the events that transpire in actual casino play. The display screen depicts the top view of a Blackjack table. You interact with the program just as you would an actual game. Computer controlled players occupy adjacent seats. All events occur in real-time.

BLACKJACK TEACHER teaches seven different strategies of varying complexity and accuracy. This spectrum of strategies allows you to select a strategy that suits your needs.

BLACKJACK TEACHER monitors your betting and strategy decisions (hit/stand/double/split/insurance). If your decisions are incorrect within the guidelines of your strategy, the system will display error messages showing you the correct decisions.

BLACKJACK TEACHER is the result of over ten years of Blackjack research. The strategies encompassed by the system were developed using computers. The more complex strategies are among the most powerful ever devised.

Complete documentation is included which tells you everything you need to know to become an expert strategy player.

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Cassette Interface For VIC/64

A. C. Pendleton

The VIAC (VIC Interface to Any Cassette) is very well named. It is a unit that allows the use of a conventional audio cassette recorder as a storage and playback device for the VIC-20, Commodore 64 or any Commodore computer designed to work with the Commodore Datassette recorder.

The VIAC and a cassette recorder duplicate all the functions of the Datassette, plus provide a number of features not available with the Datassette.

Before rushing out to buy a VIAC or similar unit, however, a word of caution might be in order. The Commodore Datassette is specifically designed to handle the Commodore signal format and, generally speaking, offers a higher degree of accuracy and reliability than a conventional audio cassette recorder. More on this subject later.

Good Documentation

The VIAC does have a number of things going for it, and if you are contemplating the purchase of a VIC or 64 and already own an audio cassette recorder, you can save a few dollars over the Datassette.

The VIAC fits in one hand and comes in an attractive and well-constructed case. Cables are attached to plug into the VIC or 64 cassette interface and the earphone, microphone, and remote-control jacks of the audio cassette recorder.

Switches let you select positive or negative polarity and run or standby mode. An earphone jack and LED indicator permit data monitoring.

In the run mode, all functions of the cassette recorder are under computer control, as with the Datassette. In the standby mode, computer control is disabled and the cassette recorder is operated manually.

The documentation is well done and provides a step-by-step procedure for setting up and using the VIAC with almost any cassette recorder.

Using the VIAC and a cassette recorder was slightly more complicated than using the Datassette, but after a while it became second nature.

As noted earlier, audio playback or recording of computer signals is generally more error-prone than the digital format used by the Datassette.

This could be considered a disadvantage of the VIAC, but it did not present a problem during my tests. The VIAC worked flawlessly with three brands of popular recorders. Even the level adjustment, normally a problem with audio recorders, worked well over a reasonably wide range of settings.

Easy Cassette Duplication

Some of the advantages of using the VIAC are described in the manual, and include the ability to monitor data via the earphone jacks and allowing use of Fast Forward and Rewind keys for quickly locating programs.

One very interesting feature is the ability to record audio remarks directly on the tape, thus saving memory space. These voice remarks are distorted at the VIAC monitor jack and must be monitored at the cassette output jack or by the speaker.

Another key feature is the ability to make duplicate copies for backup. Duplication works perfectly by connecting the output of one recorder to the auxiliary input jack of another.

All in all, the VIAC works as described in the manual and offers a number of extra, useful features. As your primary recorder, a VIAC-equipped cassette recorder is reliable and will save you a few dollars over a Datassette (if you already own a cassette recorder). I purchased my unit as a backup for my Datassette and to quickly make multiple copies of some of my own programs. If you have a similar need, the VIAC is very functional and meets all expectations for a cassette interface.

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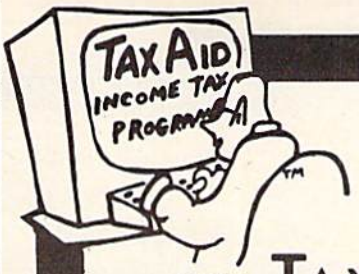
Attack Of The Phantom Karate Devils For Commodore 64

Gregg Keizer
Assistant Book Editor

The almost-invisible ninjas approach from the left, materializing from nowhere, it seems. You kick, first with your right leg, then your left, their movement almost a blur. The ninja retreats. Flailing at your enemy with both hands, you advance toward the door which opens to the secret caverns under the Shining Moon Temple. The blows echo in the doorway. The passage is open, but before you enter, you leap into the air, jumping over the dagger whistling toward you. Safe for the moment, you catch your breath, then walk into the gloom, knowing that more ninjas will replace the one you've beaten.

Attack of the Phantom Karate Devils, a game for the Commodore 64 from Phantom Software, is one of the most graphically impressive games I've seen in a long time. Your figure, made up of several sprites which move independently, is lifelike in its animation. The arms, legs, torso, and head react to your commands and to the opponents' blows. The figure's response to your commands is quick and sure, and impressive to watch.

The object of the game is simple: Make your way past the opposing ninjas, their knives and throwing stars, as far as you can toward the Control World.



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REVIEWS

As you move deeper into the ninjas' territory, you pass through caverns, across bridges, and enter new doorways. When you finally reach the Control World, you have only 15 seconds to avenge the Master, the climactic battle with the ninjas. Along the way, ninjas leap out at you, and daggers, stars, and arrows race across the screen toward you. All the while, your strength gradually fades away as you ward off the ninjas and their weapons. When your strength reaches zero, the game is over.

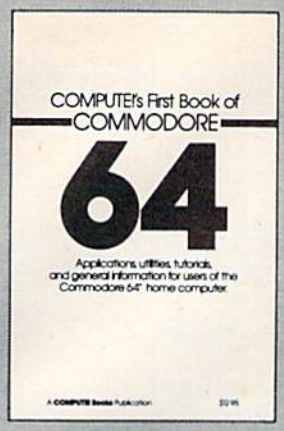
Playing The Game

Attack of the Phantom Karate Devils is a game on disk requiring a Commodore 64, a disk drive, a monitor, and a joystick plugged into port 2. Once you've seen the demonstration, press any key to read the joystick instructions displayed onscreen. The controls are rather complicated and somewhat difficult to master. For example, to jump you must press the fire button at the same time as you move the joystick to the up position. Simply pushing the joystick up, however, makes your figure kick with the left leg. Arm movement is even more elaborate. To punch with the left hand, you push the joystick to the left. Depending on whether you push it to the left and up, to the left, or to the left and down, the figure punches high, middle, or low with the left hand. The joystick controls are hard to get used to at first, but with a bit of practice they become more comfortable. The advantage of such controls is that the figure moves exactly as you want it to. You can make the figure walk, jump, hit a series of blows with either hand, or even kick with either leg. It all looks so lifelike that you soon forget your impatience with the joystick and your first fumbling attempts at controlling the figure.

Once you've read the instructions, you press any key to start the game. Your figure will appear in the Temple garden, on the right side of the screen. An enemy ninja soon leaps toward you from the left. A display on the far right-hand side of the screen shows your figure's present strength, points scored, DAN level (level of karate expertise), and high score and DAN level so far.

The most important are the strength and score displays. As your figure throws blows and is hit by ninjas and their weapons in turn, your strength level drops. Each punch or kick you make deducts points from your strength total. For instance, kicking with the left leg subtracts four points, while punching with the left hand subtracts only one point. Being hit by a dagger or star deducts ten points from your strength, so these should be avoided if possible. Each blow landed by a ninja reduces your strength by one point. Keep track of your strength total: Once it nears zero, you're in danger of losing the game. The only way to replace your strength is to pass through a doorway, or be promoted to a higher DAN level.

The ninjas always approach from the left. Wait until they are close, or advance toward them, before you begin throwing punches or kicks. Otherwise the blows will be wasted, and your strength will fall. The most powerful blow you have is a left kick. Using it when the game first begins, you'll quickly back up the ninja, and the door will open to the caverns. Once your strength falls below 100, you can't use the left kick. Your right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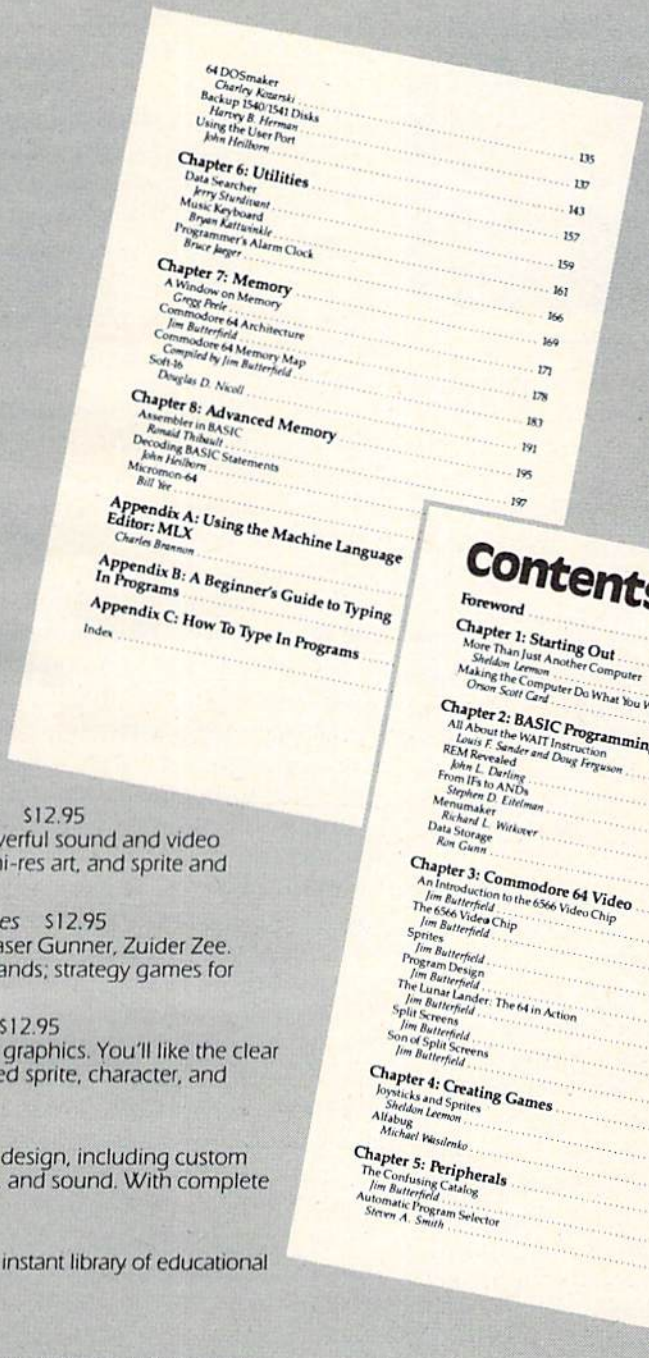

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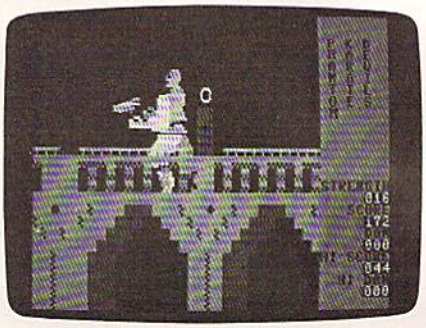
With a pagoda in the background, you begin the game by fighting your way past a phantom opponent with deadly chopping hands.



Later, you must fight your way over a bridge. The scenes scroll horizontally across the screen.

leg kick will work until your strength falls under 60 points.

You'll see daggers and stars heading toward you from time to time. Like the ninjas, they'll always enter from the left. Ward them off with your hands, feet, or by jumping above them, out of their way. Remember that a dagger or star reduces your strength ten times more than a ninja's punch.

As you kick and punch, landing blows on the ninja in front of you, your score will rise. Soon the door to the caverns will open to you, and you can walk or jump through. Jumping through doors adds 50 points to your score, so try to do that if you can. As soon as you move through the door, your strength level is reset, and you're able to use your full abilities again. You'll find yourself in a tunnel-like cavern, which scrolls from left to right. Always move to the left if you can, especially if there is no ninja in front of you. The more you move, the closer you'll be to the next door.

This leads to the bridge, which also scrolls as you make your way to the left. More ninjas will appear, more daggers and stars will come at you, often at low level. They are difficult to see, for they are hidden by the bridge's structure at times. Leaping over them works the best. If you're good, scoring points as you pummel the ninjas, you'll be promoted in DAN to level 1. Your score will be reset to zero, and you continue toward the Control World.

The Control World contains a larger-than-life ninja who tosses bombs at you while daggers, stars, and arrows fly through the air. Defeating the ninja in the Control World is difficult, but not impossible. The screen may look like random garbage to you when you enter the Control World, but there's nothing wrong with your computer — that's the way it's supposed to look, according to the game's programmer, John Orthel. Unfortunately, it's very difficult to discern anything but your own figure when you're in this section of the game display. Considering the graphic excellence of the rest of the game, this was a disappointment. A dazzling display for this climactic scene of the game would have been far more impressive.

If you do beat off this last ninja's attacks, flinging aside the bombs he throws at you, the game ends and your score and DAN level will show on the screen.

Graphically Entertaining

Attack of the Phantom Karate Devils is a game which uses the Commodore 64's graphic capabilities well. Although the scrolling effect and flying objects such as daggers or stars add to the game, it is the animation of the player's figure which makes the game so much fun to watch and play. The movement of the figure is smooth and lifelike, but very responsive to the joystick. At times too responsive, for the figure lands blows so quickly (just like the actors in those wild karate movies) that you can lose strength points too fast if you're not careful. The only disappointment was in the final scene, the Control World. Had this been as appealing to the eye as the rest of the program, I would have been happy to play it again and again. As it stands, the game is excellent, but not perfect.

The use of sound in this game is also quite good. As the blows land or miss, you'll hear appropriate sounds, from sharp knocks to near misses. You can almost hear the sound of fabric moving as your figure kicks and punches.

The joystick controls, although complicated at first, are necessary to create the separate movements of the figure. The ability to punch with only one hand, for example, makes the game more realistic than if the controls were simplified.

This isn't a game you can sit down and play well without some practice. I had to play a

number of games before I reached the Control World, sometimes not getting any further than the opening scene. But the practice is worth it. Finally opening that door to the Control World will give you the satisfaction of having defeated the ninja hordes in true karate style.

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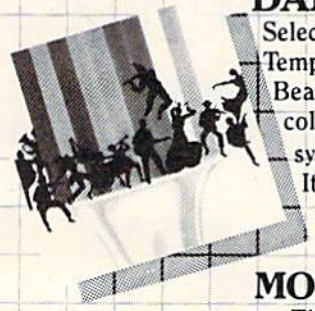

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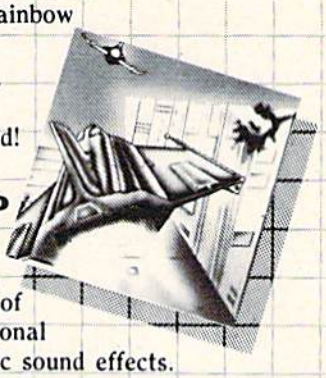

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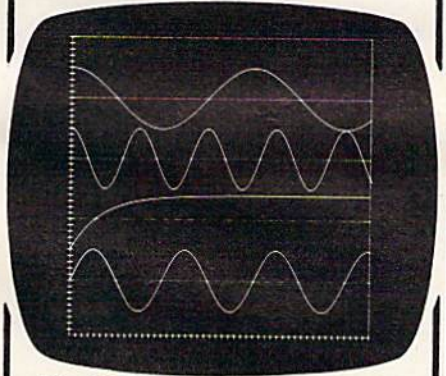

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Multicolor Character Generator For VIC-20

Bill Gates

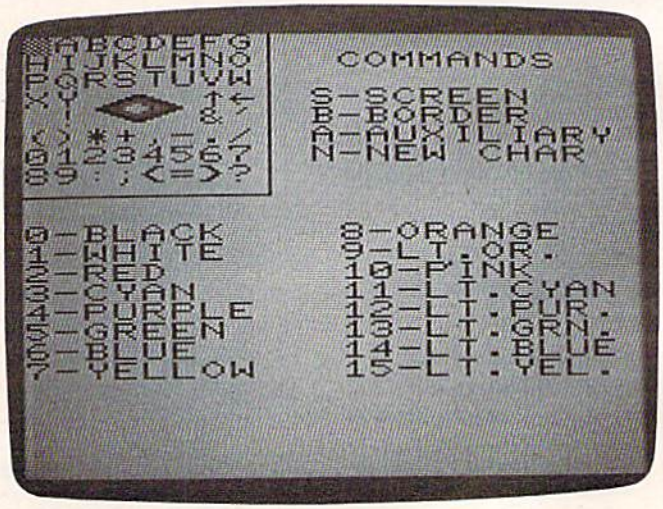
For the unexpanded VIC-20, "Multicolor Character Generator" greatly simplifies the complex task of designing multicolored characters. If you are unfamiliar with the basic techniques of custom characters, see "Introduction To Custom Characters For VIC And 64" and related articles in the November 1983 issue of COMPUTE!'s GAZETTE.

The Commodore VIC-20 has the capability to produce stunning, high-resolution color graphics. You can design a spaceship that has red engines, blue wings, and an orange nose cone—or even a monster with a green head, pink body, and purple legs. Unfortunately, designing multicolor characters has been a tedious time-consuming process which involved laboriously translating characters on paper into numbers that the computer can understand. "Multicolor Character Generator" solves this problem.

Multicolor Character Generator is an interactive *utility* program (a program which helps you with your programming) that makes designing and using your own multicolor characters easy. It allows you to design your custom characters in four different colors, using a pseudo-cursor and an enlarged picture of the character. Then it generates the code necessary to use your multicolored creation in your own programs. This article will show you how to use Multicolor Character Generator and explains how to use the characters in your own programs.

Using The Program

When you run the program, the screen clears and a display is set up showing 64 standard characters, a list of commands, and a list of all 16 color choices. Now, choose the colors you wish to use. Each character has four color choices: screen, border, auxiliary, and character colors. The character color can be different for each character, but the screen, border, and auxiliary colors must be the same for all characters on the screen. Therefore, remember that even though the program allows you to change these three colors at any time, changing



The main menu screen for "Multicolor Character Generator." Notice the diamond-shaped multicolor character which has been designed with ordinary characters.

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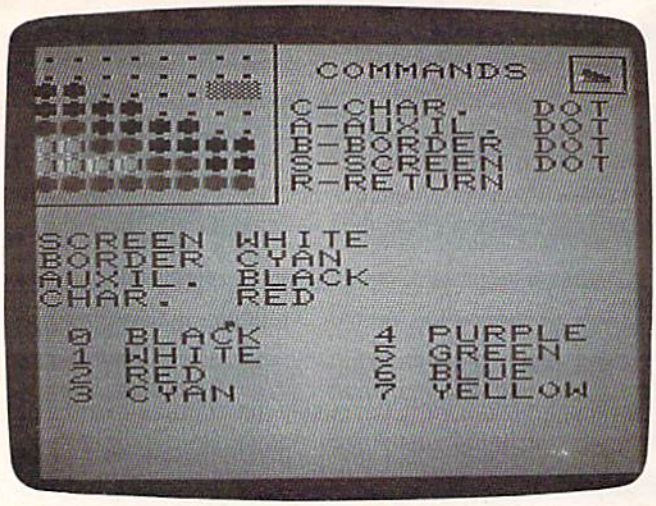

Multicolor characters are designed with this menu screen, dot by dot.

them will affect all the characters you have designed. So, it would be wise to stick with your three initial color choices unless you plan to redo all the characters you've created.

To make these three choices, press either S, B, or A to select or change the screen, border, or auxiliary colors, respectively. A question appears below the color choice and specifies the range of colors allowed. Type the number that corresponds to the color you want, then press RETURN. Once you have picked a combination of the three colors, use the cursor control keys to move the pseudo-cursor (the graphic symbol in "home" position) to one of the 64 standard characters you wish to replace with the custom character you are about to design. To enter the designing mode, press N for "new character."

When you enter the designing mode, the screen clears and a new display appears. You are then asked to select the character color with the choices listed above the question. Enter the proper number, then press RETURN. You are now ready to make your own multicolor character.

In the upper-left quarter of your screen appears an 8×8 character grid of dots. This is an enlarged representation of the character's pixel pattern in which you will create your multicolor character. In the "home" position is your two-character pseudo-cursor. It is two characters wide because in multicolor mode each dot is two pixels wide. This cursor is also moved with the cursor controls. Move the cursor to where you want a multicolor dot drawn, and press either S, B, A, or C to draw the dot in either screen, border, auxiliary, or character color. Drawing a dot in screen color erases a previously drawn dot.

A very helpful feature of the program is that the actual character in multicolor mode appears in a small box in the top-right corner of the screen, so you may see what you are really creating in the enlarged grid. When you have finished the character, press R and all the numbers for that character will appear. Write these numbers down, because you will need them for your own programs. Pressing another key returns you to the original mode of the program so you can select another character to be replaced.

Incorporating The Characters Into Your Own Programs

Here's an outline of the steps necessary for incorporating into your own programs the multicolor characters you design with the Multicolor Character Generator. The outline also shows how to use the numbers it generated.

1. First, you must reserve memory for the characters in RAM by using the following line of BASIC: POKE 52, 28: POKE 56, 28: CLR. (For the unexpanded VIC.)

2. Next, POKE 36869, 255. This tells the VIC where to find your characters in memory.

3. Here's where you start using the numbers given in Multicolor Character Generator. At the top of the screen on which the numbers are displayed appears something like 7168 TO 7175, followed by eight numbers. You use this by setting the following lines of BASIC:

```
FOR A=7168 TO 7175: READ B: POKE A, B: NEXT
DATA 255, 60, 60, 255, 7, 5, 60, 255
  (the eight numbers)
```

This places the data for your multicolor character in the RAM that was reserved.

4. POKE 36879 with the number given in the program. This sets screen and border colors.

5. POKE 36878 with the number given in the program. This sets auxiliary color. Note that this memory location also controls volume, so if you are using sound in your program, simply add 15 to the number given in the program.

6. These last POKEs depend on where you place your multicolor character on the screen. Use the charts on page 144 of *Personal Computing on the VIC-20*, the manual that comes with every VIC. Then POKE from 38400 to 38905 (use chart) with the number given in the program—it is the one following 38400. And, finally, POKE from 7680 to 8185 (use chart) with the number given in the program—it is the one following 7680. These POKEs are for the character color and screen memory.

Some Insights

In the process of writing this program, I developed some insights which I will pass along. You may notice that when designing characters with the Multicolor Character Generator, if the screen color value is greater than seven, a zero and graphic symbol appear in the bottom-right corner. (They are also there if the screen color value is less than

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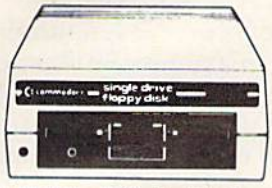

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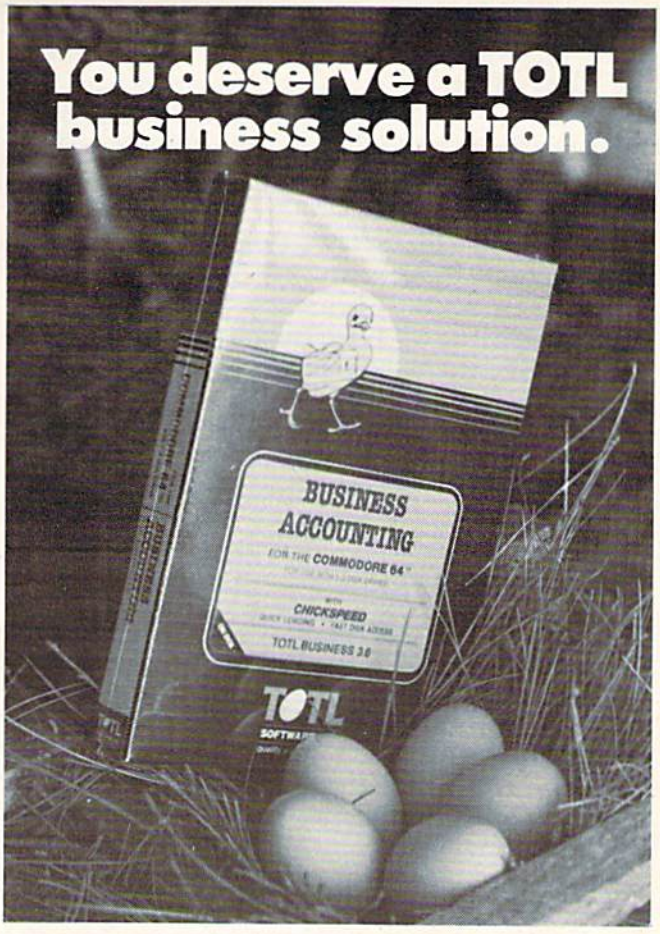

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eight, but are invisible because they are drawn in the screen color.)

The reason for this is quite interesting. The program itself required its own custom character; the problem was where to put the data for this character. I knew the character set was 2048 bytes long (256 characters × 8 bytes per character), but I had to figure out where it was located. The first 512 bytes are for the 64 characters in the program stored in locations 7168 to 7679. The last 1024 bytes wrap around to Read Only Memory (ROM) where the normal characters (nonreversed) are stored. This is actually helpful, for if you replace the letters in the first 64 characters and want to PRINT a message, using CTRL-REV will PRINT normal characters. This is also why the cursor does not blink, because what should be the reversed space is actually the standard, nonreversed space.

Now, we're left with 512 bytes unaccounted for. We can find them at the next 512 bytes of memory after 7679, or in other words, screen memory. But the screen takes only 506 bytes (22 rows × 23 columns), so there are six bytes free. Six bytes are not enough to make a character; it takes eight. And that is why those two mystery characters appear on the screen—they are part of a custom character used in the program, with the rest hidden in six bytes of unused screen memory.

If you are wondering what character I went through so much trouble to squeeze in, it is the circle character which represents a bit turned "on." I could not use the normal circle character because if the auxiliary color value were greater than seven, it would appear in multicolor mode looking very strange—certainly not user-friendly.

Typing It In

When typing this program, be careful. First of all, it works only on an unexpanded VIC, so if you have any memory expansion, remove or disable it. Next, remember the program takes virtually all memory available to BASIC. Use absolutely no spaces except those inside quotes. Also, a number of program lines exceed the maximum 80 characters. To type these lines, you must use the abbreviations listed on page 133 of your VIC manual, or the computer simply will not accept the long line.

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See program listing on page 184.

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MACHINE LANGUAGE FOR BEGINNERS

RICHARD MANSFIELD, SENIOR EDITOR

Tapping Into BASIC

It's all inside there, sparkling like a castle of crystal, waiting for you to say the magic word. BASIC is a collection of machine language (ML) programs. Sometimes, jumping into these prewritten routines is the best solution to an ML problem.

For example, there's one routine which prints a character to the screen. If you JSR 65490, whatever character is held in the accumulator will appear on the screen. Try it from BASIC: POKE 5000,169: POKE 5001,65: POKE 5002,96: SYS 5000: SYS 65490. The 169 is LDA (LoaD the Accumulator), 65 is the letter A, 96 is RTS (just like BASIC's RETURN). So, we SYS to the little ML program we've POKEd in at 5000 and then SYS to the PRINT ML routine within BASIC's ROM collection. If you wanted to print a B, you could just POKE 5001,66.

From ML, you can directly LDA with the character of your choice and then JSR 65490. This is one of the more important BASIC routines to tap into when programming in ML. Why bother? Why not just LDA and then STA (STore the Accumulator) to a known screen RAM address? You could, but you'd then have to keep track of where the cursor is, where each letter is going, and you couldn't send useful formatting and control characters like a carriage return. 65490 is a perfect way to send messages to screen from within ML. And it's much faster than BASIC's PRINT command. Nothing needs to be looked up or interpreted—you're sending control right to the ML within BASIC itself.

The easiest way to print messages on screen in ML is to set aside an area of memory as a message zone. For instance, we could decide to store all our messages between addresses 1000 and 1500. Then, knowing the starting address of each message, we could print any of them easily. Assume that you need to print the words FINAL SCORE at the top left of the screen:

1. When writing your ML program, store 19 (cursor to home position), 70 (the letter F), 73 (I), 78 (N)...until the message is complete. (These letter codes are found as appendices to many books, and a complete table was published in COMPUTE!, November 1983, p. 251.)

2. If you choose to store this message at address 1040, then you can write a short ML routine to print it out, incrementing the Y register from 0 until it equals the total number of characters in the message (12, in this case):

```
5000 LDY #0
5002 LDA 1040,Y (This is the indexed addressing we
                 talked about last month.)
5005 JSR 65490
5008 INY
5009 CPY #12
5011 BNE 5002
```

Something Accidental

What about RND? That's going to be needed in ML games quite often, and it's certainly not going to be easy to duplicate the twisted, lengthy method required to get something accidental out of these relentlessly logical machines. How would you get random numbers in ML? At first you might think you could just PEEK (LDA) the jiffy clock location in zero page (the first 256 memory cells), which is location 162 and which is very rapidly flipping numbers around. From BASIC, try:

```
10 ? PEEK (162);: GOTO 10
```

This is the internal clock, updating itself. Unfortunately, it's not like a clock hanging on the wall. If it were, you could glance at the second hand from time to time and get a fairly random series of numbers that way. The computer's clock governs the timing of events (including BASIC and ML) within the computer—if you regularly call upon the clock for random numbers, you'll be disappointed. Such calls will be controlled by the clock itself.

This is a good chance to use the built-in RND

function. To see how, let's follow the logic of Program 1, the 64 version of this month's addition to our all-ML game. So far, we've filled the color RAM and drawn a frame around the screen. Now we'll put 20 game characters on the top of the screen, in a random pattern. This way, the game will be different each time it's played.

First, we LDA with the number (#) 20 and store this count into address 204 (it's OK to use address 204; it's used by BASIC for the flashing cursor and so will remain unused during ML execution). 204 will hold the number of times we go through the loop, placing characters randomly on screen.

Then in line 29228 we JSR (Jump to Sub-Routine) at 57502 which is the entrance to RND within BASIC's ROM memory. The ML instructions at this address go through a complicated process designed to come up with an unpredictable number. That number is then stored in a zero page location called the Floating Point Accumulator #1, found in addresses 97–102. Non-integer numbers (ones with decimal points) are stored here in a crushed format: exponent, mantissa, and sign. We needn't worry about that, though. We can simply rely on the fact that after this JSR into RND, a random number between 128 and 255 will appear in address 98, ready for us to pick it up and use it however we wish.

Next, we load the Y register with the random number and, using Y as an offset, we check to see if our intended location is already used—that is, if it is part of our screen border. We LDA 936,Y and CMP (compare) it to the border character (224) to see if this location does, in fact, make up part of the border. We don't want to POKE (STA) into the border, so if the CMP is true then the BEQ (Branch if EQual) will take effect and send us back to try for another random number (BEQ 49228, our JSR into RND).

If there is no border there, however, we can LDA with the new character's code (90) and go ahead and store it on screen (STA 936,Y) at the random location. Then we DEC (DECrement, lower by one) the number we stored in address 204 which is acting as a counter for our loop. If it's not yet zero (BNE means Branch if Not Equal to zero), we loop back and JSR into RND once again. This will happen until we've been through the cycle 20 times and address 204 has been DECed down to zero.

Where did we get the 936 in LDA and STA 936,Y? Recall that the RND function is only going to give us numbers between 128 and 255. So, to avoid 128 blank spaces (where no character will ever be printed), we can't use the start of screen RAM (1024) as our initial target address. What's more, we don't want to put anything on the very top line of the screen. That would cover up our border. To decide where the first random character should potentially appear, we must subtract 128 and add the length of the top line, 40. 1024-128+40=936.

Mangled Registers

There are hundreds of frozen ML routines at your disposal with the BASIC language. In practice, you'll probably want to become familiar with a dozen or so—things like RND and disk and tape communications are far easier to accomplish if you don't have to write the ML from scratch. We'll be introducing the key routines in future columns. With each one, you'll need to make notes about what preconditions these routines expect and what effects they might have on your three registers: X, Y, and A (the accumulator). You'll be using one of these registers in nearly every ML instruction you write. Therefore, if you JSR to a BASIC routine which will affect one of them, you'll want to be aware of it.

The PRINT routine expects something in the accumulator as a precondition. It will print what it finds in A, but it has no effect on X, Y, or A. After PRINT does its work for you, it will RTS back to your ML and these registers will have been left intact.

RND, on the other hand, has no preconditions, but it does leave your registers mangled. That's why we couldn't use the X register as our counter and simply DEX down to zero. We had to set up that special register of our own at address 204.

It's easy enough to set up tests of these BASIC routines—just JSR and then look at the registers (you could, for example, LDX #1, LDY #1, LDA #1, JSR 65490, STA 828, STY 829, STX 830) and then look at addresses 828–830 to see if anything had happened to the numbers. You'll find maps of the start of ML routines in BASIC in books and in back issues of COMPUTE!. Here are a few of the more useful ones to explore: 65487—INPUT, 65490—PRINT, 65505—Check STOP key, 65508—GET, 50292—VIC's Warm Start of BASIC (control goes back to BASIC; 42100 for the 64).

Program 1: 64 Version

```
49224   LDA    # 20
49226   STA    204
49228   JSR    57502
49231   LDY    98
49233   LDA    936 ,Y
49236   CMP    # 224
49238   BEQ          49228
49240   LDA    # 90
49242   STA    936 ,Y
49245   DEC    204
49247   BNE          49228
49249   RTS
```

See program listings on page 190.

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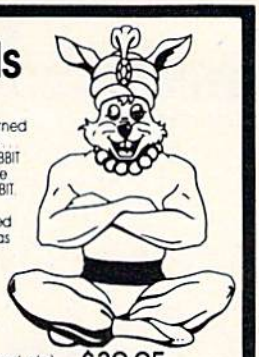

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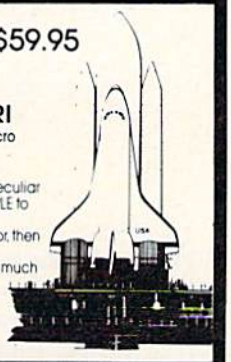

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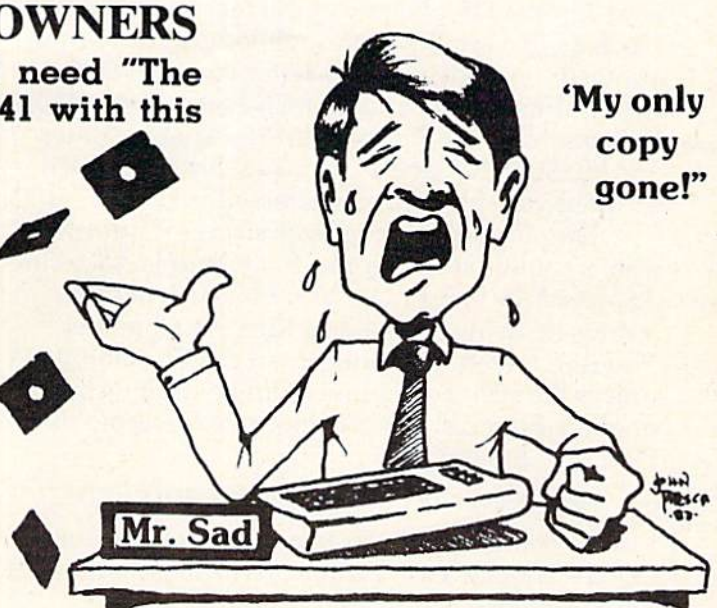

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C. REGENA

String Variables And Functions

There are essentially two kinds of values you work with on the computer: *numbers* and *strings*. Last month's column was about numeric functions. This month we'll look at strings.

A string may be a constant or a variable and may consist of letters, numbers, and symbols. In general, the BASIC language has good string-handling capabilities. You don't have to convert the names of things to numbers, so you don't have to be a mathematician to program your computer to do such things as making lists and rosters or alphabetizing titles.

Commodore BASIC Strings

In Commodore BASIC, string variable names must end with the dollar sign. The variable name may be one or two letters followed by the dollar sign and may not be one of the reserved words (such as GO or OR). Although longer names are allowed, only the first two letters will be recognized, thus BLUE$ and BLACK$ are the same to the computer (BL$). Valid string variable names are A$, SC$, N$, and N3$. String arrays or subscripted variables are also allowed.

The computer recognizes strings if information is contained in quotes. For example, to define A$, use A$="HELLO". You may also define strings by using DATA and READ statements. You don't need to use quotes in DATA statements unless the string contains leading or trailing spaces or embedded commas or colons. An acceptable DATA statement is

```
60 DATA HELLO,"ANN ",THIS IS "JOHN, ED"
```

To combine strings, use the plus sign, such as C$=A$+B$+"." Strings may not be combined with numbers.

Strings may be compared using relational operators just as with numbers, =, <, >, <=, >=, and <>. They are compared by the ASCII character code values of each letter from left to right. If N1$="CINDY" and N2$="CHERY", then N2$ is less than N1$. The first letters are the same, but the second letters are compared and H is "less than" I because the ASCII code for H (72) is less than the ASCII code for I (73). You can use this principle to alphabetize lists.

Commodore BASIC has quite a few built-in string functions. ASC(*s*) returns the ASCII character code value for a string *s*. If the string contains several characters, only the ASCII code for the first character is returned. Valid statements are:

```
10 PRINT ASC("H")
10 E=ASC(N$)
10 IF ASC(A$)=32 THEN 70
```

The following sample program gives the ASCII value of keys that you press on the keyboard.

```
100 PRINT "PRESS A KEY."          :rem 71
110 GET A$                        :rem 215
120 IF A$="" THEN 110             :rem 201
130 A=ASC(A$)                     :rem 159
140 PRINT A$,A                    :rem 244
150 GOTO 110                      :rem 97
160 END                           :rem 110
```

CHR$(*n*) returns the ASCII character corresponding to the number or numeric expression *n*. The number must be from 0 to 255. Some of the characters are actually control characters, such as ones that change the cursor to yellow or shift to lowercase. The following sample program illustrates the use of CHR$. You need to enter a number, then the computer will print the corresponding ASCII character.

```
100 PRINT                         :rem 30
110 PRINT "ENTER A NUMBER"        :rem 235
120 PRINT "FROM 33 TO 127."       :rem 105
130 INPUT N                       :rem 114
140 IF N<33 THEN 100              :rem 212
150 IF N>127 THEN 100             :rem 11
```

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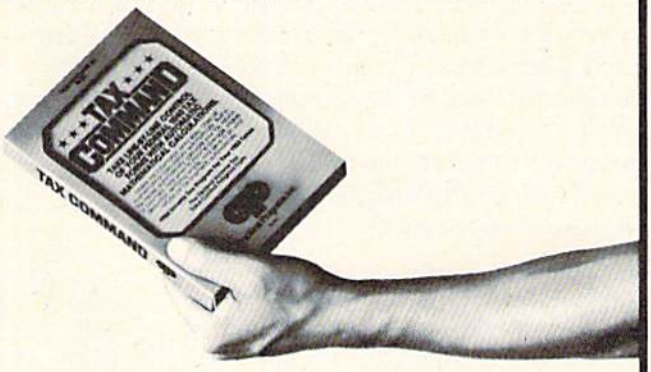

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```
160 PRINT CHR$(N)                    :rem 196
170 GOTO 130                         :rem 101
180 END                              :rem 112
```

Screen Formatting

When you print on the screen, you can format your printing to make output easier to read. The TAB function works just like the tabulator on a typewriter. The columns on the screen are numbered from 0 to 21 for the VIC-20 and 0 to 39 for the Commodore 64. If you use TAB(*c*) the printing will start in the column *c* you specify. The number *c* may be a constant, variable, or numeric expression. This sample program illustrates printing with the TAB function.

```
100 PRINT"{CLR}"                     :rem 245
110 PRINT"0123456789012345678 9"     :rem 125
120 PRINT TAB(5);"HELLO"             :rem 112
130 PRINT TAB(9);"THIS IS 9"          :rem 14
140 X=5:Y=2                           :rem 97
150 PRINT TAB(X-Y);"TEST"            :rem 232
160 FOR T=0 TO 12                     :rem 69
170 PRINT TAB(T);"GAZETTE"            :rem 52
180 NEXT T                            :rem 44
190 END                              :rem 113
```

Remember that you can use semicolons and commas to separate items in your printing. The semicolon puts two strings right next to each other. The comma starts the printing of the next item in the next print zone.

Another handy function to help you in printing is SPC(*n*), which will print *n* number of blank spaces between items. An example of the format is:

```
PRINT "ABC";SPC(6);"DEF"
```

The semicolons are optional. The following sample program illustrates several ways SPC can be used.

```
100 PRINT "HELLO";SPC(5);"READER":rem 175
110 X=3:Y=4                           :rem 94
120 PRINT "A";SPC(X+Y);"B"           :rem 180
130 FOR I=1 TO 5                      :rem 10
140 PRINT "C";SPC(I);"D"              :rem 39
150 NEXT I                            :rem 30
160 END                              :rem 110
```

You cannot combine strings with numbers or compare strings to numbers. However, there are times you will want to work with strings and numbers combined, such as names and scores. You can convert the number to a string using STR$(*n*). For example:

```
10 S=4                                :rem 37
20 N$="RANDY"                        :rem 211
30 S$=STR$(S)                        :rem 216
40 A$=N$+", "+S$                     :rem 181
50 PRINT A$                           :rem 87
```

Line 40 combines the name N$ with a comma and a space, then the number 4 which has been converted to a string.

Conversely, if you want to get back to numbers from strings for calculations, you can use VAL(*s*). This function will return the numeric value of a string *s*, and the string must contain numbers. For example, you can use a command such as N = VAL(S$).

LEN(*s*) is a string function that returns the LENgth of a string, or the number of characters in a string. For example, LEN("HELLO") is equal to the number of letters, 5. The following sample program lets the computer figure out the length of the various titles to be centered. Be sure to use the appropriate value in line 200 (11 for the VIC, and 20 for the 64).

```
100 PRINT "{CLR}"                    :rem 245
110 T$(1)="SAMPLE TITLE"              :rem 81
120 T$(2)="CENTERING"                :rem 174
130 T$(3)="BY"                       :rem 172
140 T$(4)="AUTHOR"                   :rem 230
150 FOR C=1 TO 4                       :rem 5
160 PRINT "{DOWN}"                   :rem 121
170 L=LEN(T$(C))                      :rem 93
180 REM FOR VIC LET S=11              :rem 29
190 REM FOR C64 LET S=20             :rem 233
200 S=11                             :rem 132
210 PRINT TAB(S-L/2);T$(C)           :rem 188
220 NEXT C                            :rem 22
230 END                              :rem 108
```

Line 100 clears the screen. Lines 110–140 define strings to be printed later. Line 170 calculates the length of the title, then line 210 tabulates an amount depending on the length to center the title.

Dividing Strings

If you have a string, you can look at parts of the string or segments of the whole string by using the functions MID$, LEFT$, and RIGHT$. The MID$ format is MID$(*s*,*f*,*n*) where *s* is the string expressed either in quotes or as a string variable name, *f* is the position you want to start the segment, and *n* is how many characters you want in the segment. For example, PRINT MID$("CHAIRMAN",2,4) looks at the string "CHAIRMAN" and prints the segment starting with the second letter and using four letters. The result printed is HAIR.

The following program uses the MID$ function to print a title and move it across the screen like you would see in an electronic sign or a moving marquee. Put the appropriate value in line 240 if you are using a 64.

```
100 REM MARQUEE                      :rem 133
110 GOTO 500                          :rem 96
190 REM SUBROUTINE                   :rem 142
200 D=0:S$=""                        :rem 117
210 L=LEN(M$)                        :rem 189
220 REM FOR VIC C=21                  :rem 36
230 REM FOR C64 C=39                 :rem 249
240 C=21                             :rem 121
250 K=INT((C-L)/2)                   :rem 201
```

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```
260 FOR S=1 TO K:S$=S$+"{SHIFT-SPACE}":NE
    XT S                              :rem 110
270 FOR T=C TO K STEP -1              :rem 220
280 D=D+1                             :rem 187
290 PRINT TAB(T);MID$(M$,1,D);S$+"{2 UP}"
                                      :rem 175
300 NEXT T                             :rem 38
310 RETURN                            :rem 116
500 PRINT "{CLR}"                     :rem 249
510 M$="SAMPLE TITLE"                 :rem 204
520 GOSUB 200                         :rem 169
530 PRINT                              :rem 37
540 END                               :rem 112
```

Line 290 prints the segment of the title with the length increasing by one for each loop. The TAB function decreases by one in each loop. The technique is written as a subroutine in lines 200–310 so you can use it in your own programs. Line 520 calls the subroutine. Try different messages in line 510 for M$. The message must be shorter than the number of columns in your screen (22 for the VIC, 40 for the 64).

LEFT$ and RIGHT$ are more specialized functions to work with segments of the string. LEFT$ (*s*,*n*) indicates to take the segment of string *s* starting with the leftmost character and containing *n* number of characters. LEFT$("CHAIRMAN",5) would start at the left of CHAIRMAN and use 5 letters to return the word CHAIR. RIGHT$(*s*,*n*) takes the right segment of the string *s* and containing *n* characters—the last character is the rightmost character of the original string. RIGHT$ ("CHAIRMAN",3) would be MAN.

The following program uses a subroutine containing LEFT$ and RIGHT$ functions to print a money value and line up the decimal places.

```
100 REM MONEY                         :rem 253
110 GOTO 500                           :rem 96
190 REM SUBROUTINE                    :rem 142
200 P$=STR$(P)                          :rem 1
210 IF LEN(P$)=2 THEN P$="0"+RIGHT$(P$,1)
                                      :rem 120
220 PR$=RIGHT$(P$,2)                   :rem 92
230 PL$=LEFT$(P$,LEN(P$)-2)           :rem 213
240 IF LEN(PL$)<2 THEN PL$="{2 SPACES}"
                                      :rem 243
250 P$="$"+PL$+"."+PR$                 :rem 41
260 RETURN                            :rem 120
500 PRINT "{CLR}"                     :rem 249
510 PRINT                              :rem 35
520 PRINT "ENTER A WHOLE NUMBER"      :rem 111
530 PRINT"FROM 0 TO 999"               :rem 27
540 INPUT P                           :rem 121
550 IF P<0 THEN 510                   :rem 170
560 IF P>999 THEN 510                  :rem 40
570 P$=STR$(P)                         :rem 11
580 FOR J=1 TO LEN(P$)                :rem 131
590 IF MID$(P$,J,1)="." THEN 510       :rem 55
600 NEXT J                             :rem 31
610 GOSUB 200                         :rem 169
620 PRINT TAB(10);P$                   :rem 93
630 GOTO 540                          :rem 107
640 END                               :rem 113
```

You can enter an amount of money expressed in the number of cents, a whole number from zero to 999. The value you input is P. Lines 570–600 make sure you have entered a whole number and not a decimal. The subroutine in lines 200–260 convert the price P to a money value to be printed as P$. If you were using the subroutine in your own program, you would be calculating values for P (or reading them in from DATA) and would not have to use lines 570–600 to check for a valid P.

The string-handling capabilities of your computer allow for great versatility in applications. Although a computer can be used as an improved calculator for arithmetic functions, the string functions allow programming and information handling in a variety of other uses.

The final program this month offers a drill in identifying verbs. This program uses string arrays A$, B$, and C$. Lines 180–240 read in words to fill the string arrays—subjects, verbs, and adverbs. Lines 290–320 choose random numbers, then lines 340 and 360 print the test sentence. The user types the verb of the sentence and then RETURN. The quiz consists of 10 sentences, after which a score is printed. Lines 270, 400, and 470 illustrate how string comparisons can be used.

Verbs

```
100 REM IDENTIFYING VERBS             :rem 49
110 PRINT "{CLR}"                     :rem 246
120 PRINT TAB(6);"*********"          :rem 119
130 PRINT TAB(6);"* VERBS *"          :rem 212
140 PRINT TAB(6);"*********"          :rem 121
150 PRINT "{3 DOWN}GIVEN A SENTENCE,"
                                      :rem 213
160 PRINT "{DOWN}TYPE THE VERB"       :rem 203
170 PRINT "{DOWN}THEN PRESS RETURN."
                                       :rem 68
180 FOR C=0 TO 9                       :rem 12
190 READ A$(C),B$(C),C$(C)            :rem 252
200 NEXT C                             :rem 20
210 DATA THE CAT,RAN,DOWN,A DOG,JUMPED,AR
    OUND,BOBBY,MOVED,QUICKLY          :rem 147
220 DATA CINDY,JOGGED,AN HOUR,A BOY,CRAWL
    ED,FAST,A GIRL,SKIPPED,HOME        :rem 5
230 DATA JUSTIN,RODE,TO TOWN,KIM,HOPPED,S
    LOWLY,MY PAL,HIKED,THERE          :rem 236
240 DATA THEY,CLIMBED,HAPPILY          :rem 73
250 PRINT "{3 DOWN}PRESS RETURN TO START.
    "                                 :rem 103
260 GET E$:IF E$="" THEN 260           :rem 91
270 IF ASC(E$)<>13 THEN 260            :rem 94
280 FOR T=1 TO 10:PRINT "{CLR}"       :rem 229
290 A=INT(RND(0)*10)                   :rem 69
300 B=INT(RND(0)*10)                   :rem 62
310 C=INT(RND(0)*10)                   :rem 64
320 S=INT(RND(0)*2)                    :rem 34
330 ON S+1 GOTO 340,360               :rem 119
340 PRINT A$(A);" ";B$(B);" ";C$(C);"."
                                       :rem 48
350 GOTO 370                          :rem 107
360 PRINT C$(C);" ";A$(A);" ";B$(B);"."
                                       :rem 50
370 PRINT:V$=""                        :rem 92
380 INPUT "VERB =";V$                 :rem 144
390 PRINT                              :rem 41
```

```
400 IF V$=B$(B) THEN 430          :rem 153
410 PRINT "THE VERB IS ";B$(B)     :rem 70
420 GOTO 450                      :rem 104
430 PRINT "CORRECT!!"             :rem 188
440 SC=SC+1                        :rem 93
450 PRINT "{DOWN}PRESS RETURN."    :rem 22
460 GET E$:IF E$="" THEN 460       :rem 95
470 IF ASC(E$)<13 THEN 460         :rem 36
480 NEXT T                         :rem 47
490 PRINT "{CLR}"                   :rem 1
500 PRINT"VERBS"                  :rem 232
510 PRINT "{2 DOWN}YOUR SCORE IS":rem 240
520 PRINT SC;" RIGHT OUT OF 10.{2 DOWN}"
                                  :rem 245
530 END                           :rem 111
```

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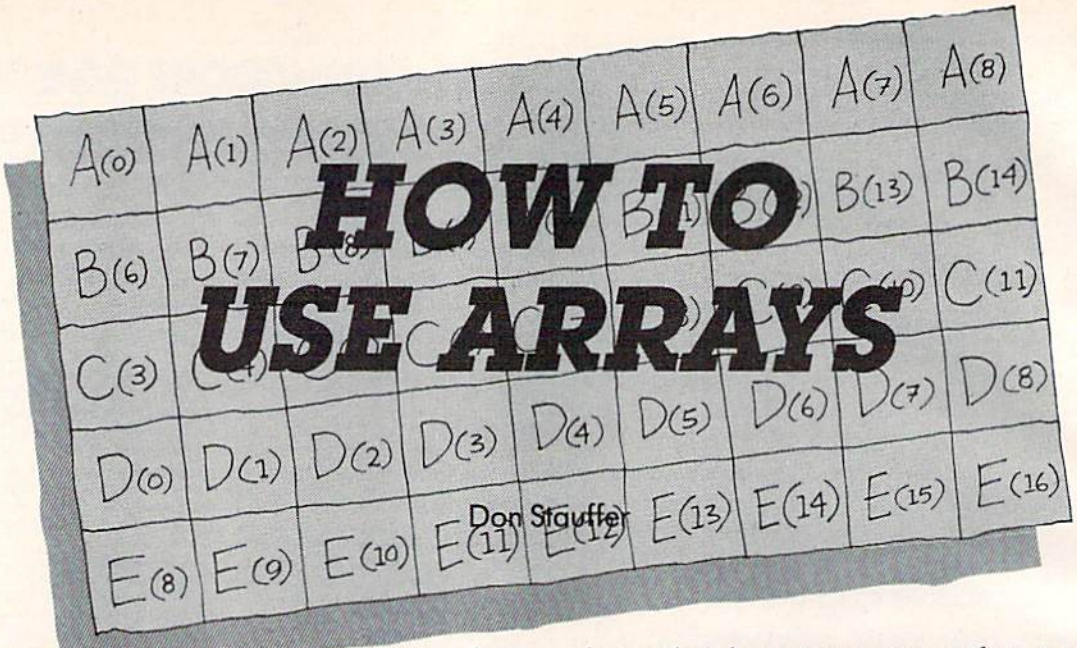

HOW TO USE ARRAYS

Don Stauffer

Using arrays is a handy BASIC programming technique. This tutorial explains what they are and how to use them when programming on your VIC or 64.

Arrays, sometimes called subscripted variables, are an important feature of Microsoft BASIC, but there is little documentation on what they are and how to use them. This is particularly true of the VIC and 64.

Some time ago, a friend of mine, a new VIC owner, called with a programming problem. He was working on a program in which he needed to generate random numbers for a variable (R). However, he wanted ten different values for R and wanted to save them for later use in the program, in statements where he would use these R values in calculations. I told him that was a perfect spot to use an array. After he looked up arrays in all the reference books he had on the machine, he wasn't much better off than when he first called, so we spent a session going over arrays. It seemed to me that the best way to know how to use arrays was to start with the basics.

What Is An Array?

An array is a type of variable which can have a number of values at any one time. For instance, let's look at a variable, T, which might stand for the maximum temperature for a particular day. T(1) might be the temperature of day 1, T(2) the temperature of day 2, and so on. The number in the parentheses is called the *subscript*. In fact, arrays are sometimes called *subscripted variables*. Although the best way to understand arrays is through examples, which we'll get to shortly, we should first learn a little about how the computer stores and uses arrays.

Since an array is a set of several values, it obviously takes more memory than a normal variable. In fact, unless the computer knows how many values your variable will have, it does not really know how much memory to set aside for that variable. We tell this information to the computer with a DIMension statement:

```
DIM X(15),Y(20)
```

In this example, we told the program we were going to use two arrays, X and Y, and that X would have a maximum of *16* values, and Y would have a maximum of *21*. Notice that the number of values set up is always one greater than the number specified in the DIM statement. Although it's confusing, this is because the computer starts counting with 0, not 1. To avoid confusion, some programmers simply ignore the 0 and treat X(15) as an array of 15 values. This wastes a tiny amount of memory, but it usually doesn't matter.

With the VIC and 64, the DIMension statement is optional unless you are going to use more than 11 values. I recommend, however, that you always DIMension arrays, even if they will have less than 11 values. It is good programming practice, and it will save considerable memory since the computer will not set aside unnecessary memory space. Also, the DIM statement initially sets all array values to zero. Good programming practice dictates that the array should be DIMensioned in one of the first statements of the program, and it obviously must occur before any reference to the array. The DIM statement must not be executed more than once, however, or an error results.

The particular value of an array is called the subscript, which is why the array is sometimes called a subscripted variable. In the following statement:

```
LET X(5)=27.3
```

subscript 5 of the X array is set to 27.3. Whenever

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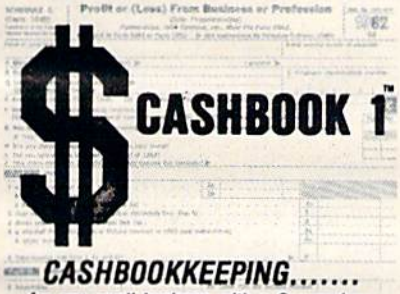

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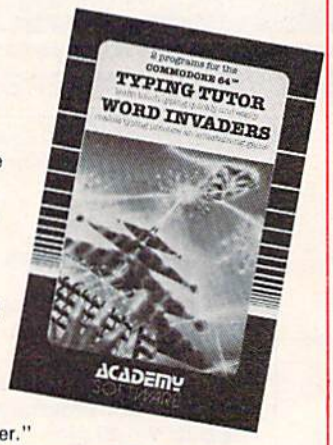

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the computer comes across a set of parentheses with a number enclosed following a variable name, it knows you are indicating an array. From now on, we will call each separate value in an array an *element*. In our previous DIMension statement, we indicated that X would have 16 elements, and Y would have 21. In the assignment statement, we set element 5 of the X array to 27.3.

As an example of the use of arrays, let's take a look at Program 1, which is part of my friend's program.

Program 1

```
10 PRINT"{CLR}":DIM R(10)                    :rem 221
100 FOR N=1 TO 10                             :rem 56
110 R(N)=INT(RND(1)*10+1)                     :rem 73
120 NEXT N                                    :rem 32
130 REM MAIN PART OF{6 SPACES}PROGRAM FOL
    LOWS                                     :rem 167
140 GOSUB 500                                :rem 170
150 PRINT:PRINT"PRESS A KEY TO COMPUTE";:
    PRINT"{3 SPACES}ANOTHER AVERAGE"
                                             :rem 247
160 GETA$:IF A$=""THEN 160                    :rem 81
170 PRINT"{CLR}":GOTO100                       :rem 0
500 REM SUBROUTINE FOR{4 SPACES}COMPUTING
     AVERAGE{5 SPACES}R                      :rem 115
510 SM=0                                     :rem 163
515 PRINT:PRINT"{RVS}ARRAY{OFF}{2 SPACES}
    {RVS}VALUES{OFF}":PRINT                  :rem 145
520 FOR N=1 TO 10                             :rem 62
530 SM=SM+R(N)                                :rem 49
535 PRINT"R(";N;")=";R(N)                    :rem 130
540 NEXT N                                    :rem 38
550 AV=SM/10                                 :rem 158
560 PRINT:PRINT"AVERAGE =";{5 SPACES}AV
                                              :rem 61
570 RETURN                                   :rem 124
```

Line 10 contains the DIMension statement. Lines 100–120 assign ten random numbers to the ten locations or variables of the R array. The main part of the program is irrelevant to our discussion of arrays, but the subroutine starting at line 500 uses the array further and is a good example. The program is written to find the average value of the ten numbers. The sum is first set to zero in line 510. The FOR-NEXT loop (lines 520–540) recalls the values stored previously in line 110 and computes the sum, which is divided by ten to compute the average in line 550.

Two-Dimensional Arrays

Arrays can have more than one dimension. The arrays we've seen so far are one-dimensional. We can visualize the one-dimensional array as a line of boxes or pigeonholes, as in Figure 1, in which to place values, or a list of values like a list on a piece of paper. The one-dimensional array is probably the most common, but the two-dimensional array is used often, too. The two-dimensional array is often visualized as a table of rows and columns. For instance, an array DIMensioned by

the statement:

```
DIM X(4,3)
```

would be visualized as a table of *five* columns by *four* rows, as shown in Figure 2. Again, notice that DIM X(4,3) actually sets up a 5×4 table because the elements are numbered starting with 0. As with one-dimensional arrays, you may choose to ignore the 0 column and row, spending a few bytes of memory to eliminate a possible source of confusion.

Frequently, a particular problem can be solved by either a one- or a two-dimensional array, and the choice is strictly a matter of style, up to the programmer. Programs 2 and 3 illustrate a similar problem, the first with a one-dimensional array, and the second with a two-dimensional array.

In Program 2, the problem is to record the high temperature for each day, and then find the average high temperature for the week.

Program 2

```
20 DIM TM(7)                              :rem 101
30 REM ENTER DATA                         :rem 223
40 INPUT "{CLR}ENTER DAY NUMBER";N
                                          :rem 121
50 PRINT:PRINT "ENTER HIGH TEMPERATURE FO
   R DAY":INPUT TM(N)                     :rem 184
60 IF N<7 THEN 40                          :rem 73
70 REM                                     :rem 75
80 REM A SUBROUTINE.{5 SPACES}NOT SHOWN H
   ERE,{7 SPACES}WOULD STORE THE
   {7 SPACES}ARRAY TO TAPE                 :rem 224
100 REM                                   :rem 117
120 GOSUB 1000                            :rem 212
130 END                                   :rem 107
1000 REM ROUTINE FOR{7 SPACES}FINDING AVE
     RAGE{7 SPACES}HIGH TEMPERATURE
                                          :rem 26
1010 REM A ROUTINE FOR{5 SPACES}READING T
     HE TAPE,{5 SPACES}NOT SHOWN, WOULD
     {6 SPACES}BE INCLUDED HERE           :rem 79
1030 PRINT                                 :rem 81
1040 SM=0                                 :rem 210
1050 FOR N=1 TO 7                          :rem 67
1060 SM=SM+TM(N)                          :rem 175
1065 PRINT"DAY";N;"TEMP=";TM(N)           :rem 113
1070 NEXT N                                :rem 85
1080 AV=INT(SM/7)                         :rem 223
1090 PRINT:PRINT"AVERAGE HIGH":PRINT"TEMP
     ERATURE FOR WEEK=";AV;" DEGREES
                                          :rem 84
1100 RETURN                               :rem 162
```

The one-dimensional array TM is DIMensioned to 7. An actual application program would have some sort of data file routines, but since tape or disk file handling is another subject altogether, let's leave the storage and retrieval out. Lines 40 and 50 assign the value of the high temperature to the appropriate box in the array. The average high temperature is then found in the subroutine starting at line 1000, in the same manner as in the preceding problem.

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Program 3 handles a similar problem using a two-dimensional array.

Program 3

```
20 DIM TM(52,7)                          :rem 248
30 REM ENTER DATA                        :rem 223
40 INPUT"{CLR}ENTER WEEK NUMBER ";WK
                                         :rem 27
50 INPUT"ENTER DAY OF WEEK ";DY          :rem 46
60 PRINT"ENTER HIGH TEMPERATURE":INPUT TM
   (WK,DY)                               :rem 74
65 IF WK<52 THEN 40                      :rem 210
70 REM                                   :rem 75
80 REM SUBROUTINE 500,{3 SPACES}NOT SHOWN
    HERE,{7 SPACES}WOULD STORE            :rem 5
90 REM DATA ON TAPE                      :rem 46
100 REM GOSUB 500 TO TAPE ROUTINE HERE
                                         :rem 161
110 GOSUB 1000                           :rem 211
120 END                                  :rem 106
1000 REM READ TAPE AND{5 SPACES}COMPUTE A
     VERAGE                              :rem 214
1010 REM A TAPE READ{7 SPACES}ROUTINE, NO
     T{10 SPACES}SHOWN, WOULD BE
     {7 SPACES}FOUND HERE                :rem 221
1030 REM                                 :rem 168
1040 S1=0                                :rem 182
1050 FOR W=1 TO 52                       :rem 124
1060 S2=0                                :rem 185
1070 FOR D=1 TO 7                         :rem 59
1080 S1=S1+TM(W,D)                       :rem 242
1090 S2=S2+TM(W,D)                       :rem 245
1100 NEXT D                               :rem 69
1110 WA=S2/7                             :rem 131
1120 PRINT"WEEK ";W;"AVERAGE IS ";WA;"DEG
     REES"                               :rem 186
1130 NEXT W                               :rem 91
1140 YA=S1/365                           :rem 238
1150 PRINT"YEARLY AVERAGE HIGH TEMP"
                                         :rem 191
1160 PRINT"IS ";YA;" DEGREES"            :rem 136
1170 RETURN                              :rem 169
```

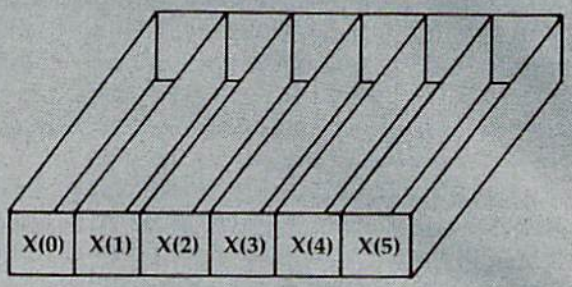
In this version, we store the temperatures week by week and day by day in a table of 52 rows of 7 columns (line 20). We have a column for every day of the week, and a row for every week of the year. The first part of the program stores our data in the array by week number and the number of the day in the week. The subroutine starting at line 1000 again figures the average, but with a new twist (as an advantage of using the two-dimensional array). Now we can find the average temperature for each week as well as for the year.

Another Use Of Arrays

Another handy use of arrays is to relate two sets of values to one another. This can easily be done if each set of values is an array, and these values can then be related by the subscript. A common use of arrays for this purpose is relating a set or sets of values to people's names. The names are held in a *string array*, such as N$(X), while the values are held in *numeric arrays* (having the same dimensions as N$, of course). Program 4 illustrates this use of arrays in a teacher's gradebook program.

Figure 1: One-Dimensional Array

A one-dimensional array can be thought of as a row of boxes or pigeonholes.



DIMX(S)

Figure 2: Two-Dimensional Array

A two-dimensional array is frequently visualized as a table of rows and columns.

	Column 0	Column 1	Column 2	Column 3	Column 4
Row 0	X(0,0)	X(1,0)	X(2,0)	X(3,0)	X(4,0)
Row 1	X(0,1)	X(1,1)	X(2,1)	X(3,1)	X(4,1)
Row 2	X(0,2)	X(1,2)	X(2,2)	X(3,2)	X(4,2)
Row 3	X(0,3)	X(1,3)	X(2,3)	X(3,3)	X(4,3)

Program 4

```
20 DIM N$(15),T1(15),T2(15),HW(15),FS(15)
                                         :rem 52
30 PRINT"{CLR}"                          :rem 199
40 REM DISPLAY MENU                      :rem 147
50 PRINT"{4 SPACES}{RVS}SELECT OPTION
   {OFF}"                                :rem 115
60 PRINT:PRINT"1-ENTER NAMES IN FILE"
                                          :rem 5
70 PRINT:PRINT"2-ENTER SCORES, FIRST
   {3 SPACES}TEST"                       :rem 159
80 PRINT:PRINT"3-ENTER SCORES, SECOND
   {2 SPACES}TEST"                       :rem 213
90 PRINT:PRINT"4-ENTER SCORES,{9 SPACES}H
   OMEWORK"                              :rem 71
100 PRINT:PRINT"5-COMPUTE FINAL SCORE"
                                         :rem 142
110 PRINT:INPUT"ENTER NUMBER";Q          :rem 0
120 ON Q GOSUB 1000,2000,3000,4000,5000
                                         :rem 128
130 END                                  :rem 107
1000 REM INITIALIZE{7 SPACES}STUDENT NAME
      FILE                               :rem 255
1010 FOR N=1 TO 15                       :rem 110
1020 INPUT"ENTER LAST NAME";N$(N):rem 182
1030 NEXT                                 :rem 3
1040 OPEN 1,1,2,"NAMES"                  :rem 199
1050 FOR N= 1 TO 15                      :rem 114
```

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```
1060 PRINT#1,N$(N)                    :rem 229
1070 NEXT N                           :rem 85
1080 CLOSE 1                          :rem 112
1090 RETURN                           :rem 170
2000 REM ENTER TEST SCORES            :rem 51
2010 OPEN 1,1,0,"NAMES"               :rem 195
2020 FOR N=1 TO 15                    :rem 112
2030 INPUT#1,N$(N)                    :rem 230
2040 NEXT N                           :rem 83
2045 CLOSE 1                          :rem 114
2050 REM ENTER DATA BY{5 SPACES}NAME
                                      :rem 255
2060 FOR N=1 TO 15                    :rem 116
2070 PRINT"ENTER SCORE FOR ";N$(N)
                                      :rem 199
2080 INPUT T1(N)                      :rem 126
2090 NEXT N                           :rem 88
2100 REM NOW SAVE T1{7 SPACES}ARRAY AS FI
     LE TO{6 SPACES}TAPE              :rem 79
2110 OPEN 2,1,2,"TEST1"               :rem 196
2120 FOR N=1 TO 15                    :rem 113
2130 PRINT#2,T1(N)                    :rem 248
2140 NEXT                              :rem 6
2150 CLOSE 2                          :rem 112
2160 RETURN                           :rem 169
3000 REM NOW WOULD{9 SPACES}FOLLOW TWO MO
     RE                               :rem 38
3010 REM SUBROUTINES{7 SPACES}LIKE THE ON
     E{10 SPACES}ABOVE, EXCEPT        :rem 85
3020 REM REPLACE T1{8 SPACES}WITH T2 IN S
     UB-{7 SPACES}ROUTINE STARTING:rem 44
3030 REM AT LINE 3000,{5 SPACES}AND CALL
     {SPACE}THE FILE{5 SPACES}"TEST2".
                                      :rem 42
3040 REM THEN USE HW{7 SPACES}AND FILENAM
     E{9 SPACES}"HMWRK" FOR THE       :rem 15
3050 REM ROUTINE AT 4000              :rem 43
4000 REM HOMEWORK FILE{5 SPACES}HERE
                                      :rem 88
5000 REM READ TAPE{9 SPACES}FILES AND COM
     PUTE{5 SPACES}SCORE              :rem 206
5010 OPEN 1,1,0,"NAMES"               :rem 198
5020 FOR N=1 TO 15                    :rem 115
5030 INPUT#1,N$(N)                    :rem 233
5040 NEXT                              :rem 8
5050 CLOSE 1                          :rem 113
5060 OPEN 2,1,0,"TEST1"               :rem 201
5070 FOR N=1 TO 15                    :rem 120
5080 INPUT#1,T1(N)                     :rem 1
5090 NEXT                             :rem 13
5100 CLOSE 2                          :rem 110
5105 INPUT"HIT RETURN TO CONTINUE";Q
                                      :rem 248
5110 OPEN 3,1,0,"TEST2"               :rem 199
5120 FOR N=1 TO 15                    :rem 116
5130 INPUT#3,T2(N)                     :rem 0
5140 NEXT                              :rem 9
5150 CLOSE 3                          :rem 116
5155 INPUT "HIT RETURN TO CONTINUE";Q
                                      :rem 253
5160 OPEN 4,1,0,"HMWRK"               :rem 228
5170 FOR N=1 TO 15                    :rem 121
5180 INPUT"4,HW(N)                     :rem 30
5190 NEXT N                           :rem 92
5200 CLOSE 4                          :rem 113
5210 REM NOW COMPUTE{7 SPACES}FINAL SCORE
                                      :rem 163
5220 FOR N= 1 TO 15                   :rem 117
5230 FS(N)=T1(N)+T2(N)+HW(N)           :rem 28
5240 NEXT N                            :rem 88
5250 REM NOW PRINT OUT{5 SPACES}SCORES
                                      :rem 248
5260 OPEN 1,4,7                       :rem 243
5270 PRINT"1,"NAME","SCORE"            :rem 43
5280 FOR N = 1 TO 15                  :rem 123
5290 PRINT#1,N$(N),FS(N)               :rem 82
5300 NEXT N                            :rem 85
5310 RETURN                           :rem 169
```

For demonstration purposes, this program is not a complete program as it stands, and contains no error trapping or user prompts. It could, however, be expanded into a useful gradebook program with some fill-in work. It is instructive of the use of arrays to relate variables. The main program, up to line 130, creates a menu selection which sends the program to the appropriate subroutine. The first routine, starting at line 1000, is used at the beginning of the school term to enter the students' names in a string array, N$(N). The DIMension statement in line 20 of the main program, and all of the FOR-NEXT loops, would have to be adjusted to the actual number of students in the class. Subroutine 2000 would be used to enter the scores of the first test. By reading the N$ array in lines 2010 to 2045, the program prompts the teacher with the student's name for data entry (line 2070). A similar subroutine would be used for each test and maybe a homework score. Subroutine 5000 puts it all together at the end of the term. After reading the grades from all the files, line 5230 figures the grade for every student. In effect, the variable N is a student number which relates each element of each of the four files. This illustrates how N can still be used as a separate variable, even when you've set up a numeric array N(X) or a string array N$(X).

These examples of the use of the array are general but easy to expand on. Arrays can be used in a variety of ways. I'm sure that after using them for a while, you can come up with many more applications on your own.

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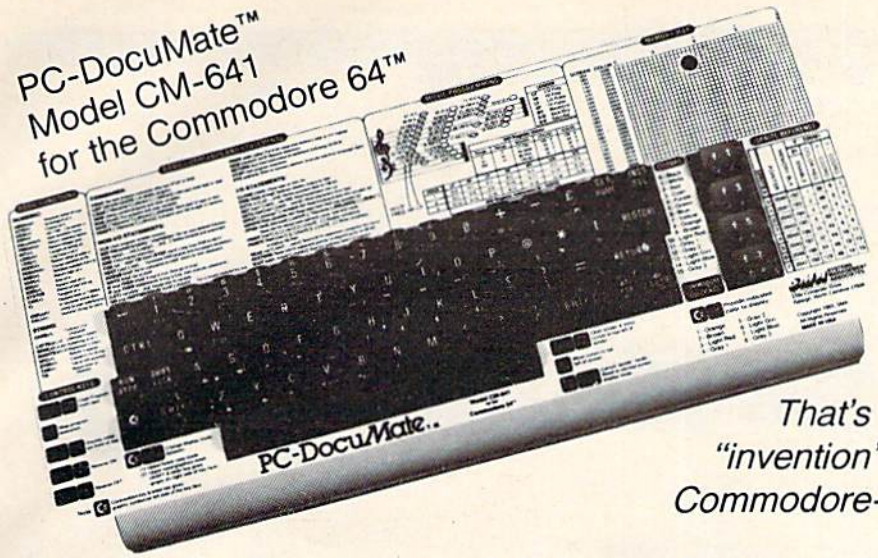

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STILL CONFUSED

We found we were confused about music programming, color graphics, and sprites. On both the VIC-20 and the CBM-64 templates we carefully organized and summarized the essential reference data for **music** programming and put it across the top—showing notes and the scale. All those values you must POKE and where to POKE them are listed.

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Auto Line Numbering

Jeff Young

This short program is a handy, time-saving utility for programmers. For the VIC and 64.

"Auto Line Numbering" is a utility for programmers which automatically generates a line number for the current BASIC program statement being entered. As written, the program begins with line 100 and increments by tens (100, 110, 120, etc.). This can be modified as described below.

How To Use The Program

"Auto Line Numbering" is a BASIC program which loads a machine language subroutine into a free block of memory. Program 1 (the 64 version) puts the subroutine at memory location 49152 ($C000). Program 2 (the VIC version) puts the subroutine at 7578 ($1D9A). These areas of memory will not be used by BASIC, so the program should be safe.

Type in the program and SAVE it. After LOADing, type RUN, press RETURN, type NEW, press RETURN, then type SYS 49152 (for the 64) or SYS 7578 (for the VIC). If you wish to leave the program for any reason, just press RETURN immediately after you see a new line number. To return to the program, type SYS 49160 (for the 64) or SYS 7586 (for the VIC). This will continue generating line numbers from where you left off.

Although the program will always begin numbering with 100 and increment by tens, you can modify either of these if you wish. If you want to begin with a number other than 100, determine the number with which you want to start, then subtract ten. Next, POKE this number in low-byte/high-byte format into 251 and 252, then SYS 49160 (for the 64) or SYS 7586 (for the VIC).

For example, if you wish to begin with line 1000, subtract ten. The number you are now working with is 990. To determine low-byte/high-byte, divide 990 by 256. The result, 3, is the number you POKE into location 252—POKE252,3. The remainder of the division is 222. Now, POKE 251,222. The low byte is location 251, and the high byte, 252.

The lines you would type, then, if you wished to begin the line numbering with 1000 are:

```
POKE 251,222:POKE 252,3
SYS 49160  (for the 64)
SYS 7586   (for the VIC)
```

To change the increment from ten, POKE the desired number into location 49179 (for the 64) or 7605 (for the VIC). If you want to increment by fives, for example:

```
POKE 49179,5  (for the 64)
POKE 7605,5   (for the VIC)
```

This utility program can save you a lot of time when programming, and it provides a neat, structured sequence for program line numbers.

Program 1: 64 Version

```
1 X=49152                                   :rem 203
2 READY:IFY=-1THEN4                         :rem 199
3 POKEX,Y:X=X+1:Z=Z+Y:GOTO2                 :rem 22
4 IFZ<>12374THENPRINT"ERROR IN DATA STATE
  MENTS":END                                :rem 236
100 DATA169,90,133,251,169,0,133,252,169,
    19,141,2,3,169,192,141,3,3,96,32,25
                                            :rem 203
110 DATA192,76,134,164,24,169,10,101,251,
    133,251,144,2,230,252,165,251,133;99
                                            :rem 246
120 DATA165,252,133,98,162,144,56,32,73,1
    88,32,221,189,162,0,189,1,1,240,9,32
                                              :rem 4
```

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```
130 DATA210,255,157,0,2,232,208,242,32,18
    ,225,201,13,240,3,76,105,165,56,165
                                    :rem 182
140 DATA251,233,20,176,2,198,252,169,131,
    141,2,3,169,164,141,3,3,76,118,165,-1
                                    :rem 36
```

Program 2: VIC Version

```
10 POKE56,29:POKE52,29:CLR:I=7578:rem 175
20 READ A:IF A=256 THEN 40          :rem 54
30 POKE I,A:I=I+1:CK=CK+A:GOTO 20:rem 129
40 IF CK<>12545 THENPRINT"{CLR}ERROR IN D
   ATA STATEMENTS"                  :rem 210
7578 DATA 169,90,133,251,169,0,133
                                    :rem 156
7586 DATA 252,169,173,141,2,3,169:rem 107
7594 DATA 29,141,3,3,96,32,179     :rem 215
7602 DATA 29,76,134,196,24,169,10:rem 104
7610 DATA 101,251,133,251,144,2,230
                                    :rem 169
7618 DATA 252,165,251,133,99,165,252
                                      :rem 3
7626 DATA 133,98,162,144,56,32,73:rem 107
7634 DATA 220,32,221,221,162,0,189
                                    :rem 132
7642 DATA 1,1,240,9,32,210,255     :rem 186
7650 DATA 157,0,2,232,208,242,32   :rem 33
7658 DATA 15,225,201,13,240,3,76   :rem 40
7666 DATA 105,197,56,165,251,233,20
                                    :rem 203
7674 DATA 176,2,198,252,169,131,141
                                    :rem 208
7682 DATA 2,3,169,196,141,3,3      :rem 154
7690 DATA 76,118,197,0,256        :rem 21
```

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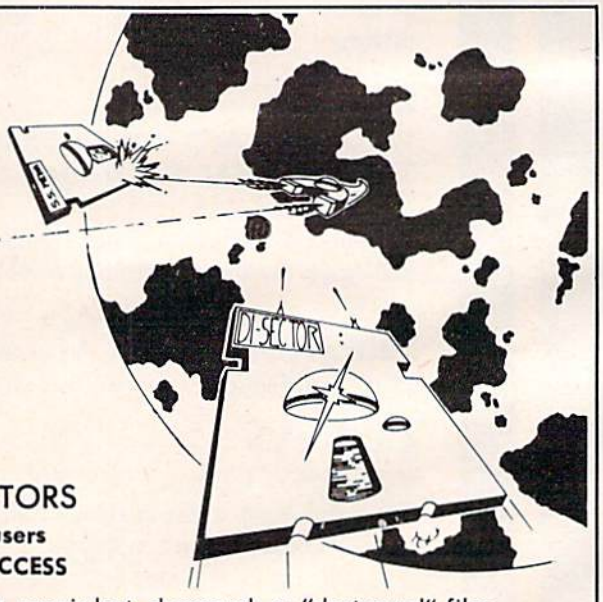

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HORIZONS: 64

CHARLES BRANNON
PROGRAM EDITOR

Singing 64

I recently got to hear The Alien Group's Voice Box speech synthesizer for the 64. If you've never heard your computer talk, it's really quite shocking.

The Voice Box is indeed a "black box" which plugs into the user port. It has a built-in amplifier and speaker, as well as two knobs for volume and pitch. With the supplied software, you can very easily make speech, using English spelling. Like all speech synthesizers, you may need to spell a word phonetically to get it to sound right, since it's almost impossible for software to master the ambiguity of English spelling.

The sample software shows what you can do with the Voice Box, including a spelling game which reads the words aloud. Most interesting is a music composition program. You can enter three-part synthesizer music and—get this—the Voice Box can sing along. The sample music is rich and vibrant, some of the best 64 sound I've heard, but that singing voice takes a bit of getting used to. If a crooning computer isn't enough, there is also a high-resolution face which changes its expression while it mouths the words. You can even edit the face to add a moustache, if you want.

There is a lot of complexity here. I would be happy with the music software alone (you don't have to use the singing option—you can compose music without the Voice Box), but the face and song could enliven any party. (A local user group enthusiastically watched a demonstration of the Voice Box and software.)

After using the Voice Box, it will be interesting to see the product of Commodore's own speech synthesis division, which is ready to market an amazing speech synthesizer for the 64. It will have chips for different "personalities" (male, female, or even children's voices). Commodore plans to market games using the speech synthesizer, such as *Gorf* and *Wizard of Wor*. I just wonder if Commodore can make it sing....

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VIC Vs. 64: Cousins, Not Siblings

What is the real difference between a VIC-20 and a Commodore 64? This is an often-asked question. Many people would like to upgrade their VIC to a 64. Others are trying to convert programs, or would like to plug VIC cartridges into a 64. It's time to get things straight. The 64 is more than a 40-column VIC.

First, what do these machines have in common?

The keyboard similarity means that you won't have to relearn the layout if you move to a 64 from a VIC.

The common BASIC is far more important. Some VIC programs do not use any special features of the VIC, so these BASIC programs work on the 64, too. The only problem is that the different screen line lengths (22 versus 40) can cause wacky screen formatting. Some other programs that use only VIC color control and normal graphics characters also work OK on the 64.

The difference in screen width is quite significant. At best, you'll use only half of your 40-column screen width when you run VIC programs on your 64. At worst, text will be strewn all over the screen, as cursor controls and screen formatting dependent on a 22-column screen go awry.

Most BASIC game programs POKE characters to the screen for animation. Even if you change the screen address to 1024 for the 64, and color memory to 55296, the POKEs are still based on a line length of 22. Many times the POKEs appear like this:

```
POKE 7815,81
```

This is not too hard to convert. Subtract 7680, the start of screen memory:

```
?7815–7680
135
```

Divide by 22 to get the row:

```
?INT(135/22)
6
```

Now the column is the remainder:

```
?135–22*6
3
```

Now reassemble it to a 64 POKE:

```
?1024+40*6+3
1267
```

So the equivalent to the VIC POKE is:

```
POKE 1267,81
```

That wasn't so hard, eh?

Another effect of the 64's wider screen is that the characters are smaller. Frequently, VIC game characters come out looking cramped and smeared when moved over to the 64.

Internal Similarities

The operating system in Read Only Memory (ROM) is also very similar. In fact, some VIC routines were just reassembled with very minor changes to run on the 64. The Kernal routines, used by machine language programmers for working with files, are identical. Almost all of the VIC zero-page locations are unchanged in the 64. Most other low-memory locations, such as POKE 650,128 for auto-repeat on all keys, also apply to the 64. This compatibility is just as important as the BASIC. It can make a lot of your VIC experience "transportable" to the 64.

The VIC and 64 can share the same peripherals. For example, the VICmodem plugs into and works just fine on the 64. Both machines use the same disk drive, the 1541. The 64 cannot use the 1540 disk drive, though. The extra processing time the VIC-II chip steals from the 64 required that the 1540 be slowed down to let the 64 keep up, hence the 1541. The 1540 can be upgraded to a 1541 by the replacement of a single ROM chip (performed by your service technician).

The 1525 printer can likewise be modified if necessary (1525E), but will otherwise work fine with both the VIC and 64. Future peripherals should also be compatible as long as they use the serial bus or user port (the cartridge slot is still incompatible, so no CP/M for the VIC!).

The video connections are enough alike to let you use the same video monitor, such as the Commodore 1701. And thanks to relocatable loading, you can even LOAD and modify VIC programs from the same cassette drive.

Finally, even some video graphics features are similar, most notably the same basic eight colors: black, white, red, cyan, purple, green, blue, and yellow. As mentioned, the keyboard graphics are also the same, just thickened up a bit to help their appearance on a TV. Other comparable features are: custom characters, multicolor mode, color memory, even extended background color mode.

I said comparable, not compatible. When you get to graphics and sound, the VIC and 64 are as different as Apples and oranges (or Ataris). They share a few concepts, though, such as color memory, not found on other computers. Audio/video is the major difference between the machines, and if you believe your eyes and ears, the machines have nothing in common! Fortunately, we know better.

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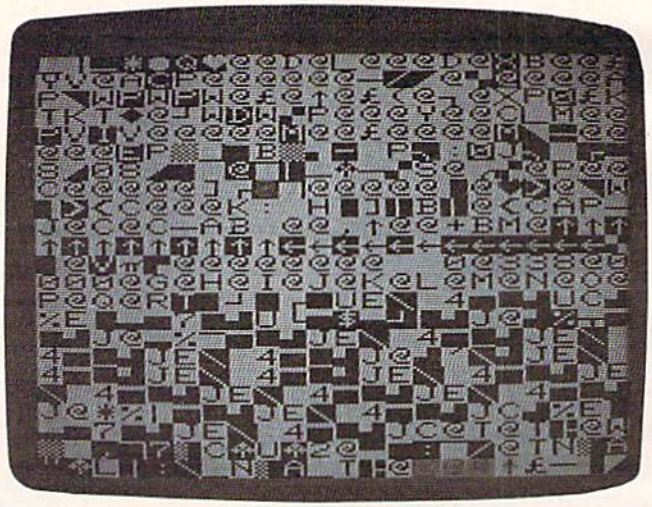
A Window Into The VIC-20

If you've ever wanted to take a look inside the VIC-20 and see what's going on, then this month's column is for you.



Here's a picture of what zero-page memory looks like in the VIC-20. The blurred light-blue block near the center of the screen is a rapidly changing internal clock.

This month we're going to take a guided tour through the VIC's memory. We'll see what's going on in both RAM and ROM, and some of the activities you see may be a surprise.

The Window Program

Before we begin our tour, let's take a look at the program we'll be using, a "window" into the VIC-20. It is basically a machine language program that will look at two *pages* (a page is 256 bytes) of memory and display it on the screen. With this program, you'll have complete control over what you see. You'll be able to scroll through the entire VIC's memory both forward and backward. If you wish to look at a specific area of memory, there's also an option to input that address into the program.

Type in the program at the end of this column, and save it to tape or disk before running. The program is a BASIC loader that will POKE a machine language program into memory. As you may know, a single error in a machine language program can cause the VIC-20 to lock up, so save the program before running it. We'll be using machine language here because of its speed.

Basically, what the program does is read the 512 bytes of memory the program window is currently looking at and store them directly into screen memory. This displays the memory on the screen. Because this column is not primarily aimed at advanced machine language programmers, I won't go into any details on how the program works. However, you machine language programmers may be interested in the technique used here. The program changes, or rewrites itself as it runs. It could have transferred memory to the screen using indirect addressing with zero-page locations, but the self-modifying version was chosen here.

Controlling The Program

To properly use the program, turn off your VIC, unplug all expansion RAM and other cartridges, then turn it back on. After you've typed in and debugged the program, enter RUN, then press RETURN. After a pause of about two seconds (as the machine language program is POKEd into memory), the screen fills with characters. You're now looking at the first two pages of the VIC's memory, or approximately memory addresses 0 through 505.

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The program is controlled with the special function keys and the back-arrow key. Here's a quick rundown of what the keys will do.

f1– Pressing the f1 key scrolls forward through the VIC's memory. Each time you press f1, it will scroll about 40 bytes, or two lines of screen memory. Holding down the f1 key will continuously scroll through memory.

f3– Pressing the f3 key scrolls backward through the VIC's memory. Scrolling backward is also done in increments of 40 bytes, or two screen lines. Holding down f3 will scroll backward continuously.

f5– Pressing the f5 key displays the beginning address of the 505 bytes of memory you're currently looking at. When you press f5, you'll see a blinking red number in the upper-left corner of the screen. This is the address of the first byte of memory currently displayed on the screen. This byte is displayed as the character at the home (upper-left corner) position of the screen. Because the VIC's screen has 506 positions, the byte at the lower-right corner is this number plus 505.

Significantly, the characters you see displayed on the screen are actually the *screen (POKE) code* values of the bytes being displayed. For example, a byte that contains a value of zero will be displayed as @, a value of one as "a", and so forth. The screen codes can be found in Appendix H of the manual which came with your VIC.

f7– Pressing the f7 key resets the display to memory address 0. That is, pressing f7 resets the program to the beginning, and bytes 0 through 505 again will be displayed on the screen.

←– Pressing the ← key (back-arrow) key puts the program into the input mode and displays the prompt: *Enter desired address*. You can now enter any address you want to see displayed (between 0 and 65275) and press RETURN. The screen will then display the 505 bytes of memory starting at the address you specified.

The Guided Tour

Now, if you're done testing the various control keys, press f7 to reset the program, climb into the tour bus, and away we'll go.

The screen display you're now looking at (starting at 0) is memory bytes 0 through 505. On the upper half of the screen, slightly to the left, you'll see a byte changing quickly. This and the two bytes to the left are the *jiffy clock*. You're actually watching the VIC's jiffy clock as it is running. Now repeatedly press any key (except one of our program control keys) on the keyboard, and watch what happens. You should see two bytes change as you press the keys. These are the two bytes (197 and 203) that tell the operating system you have pressed a key. The value placed into these bytes will reflect the specific key you pressed. At the bottom of the screen, to the right, you'll see four bytes changing rapidly. These are a few of the memory locations in the *processor stack* area. This is where the operating system temporarily stores information such as return addresses when a program performs a GOSUB. The activity here is caused by the program running.

Now press the f1 key, and scroll up to address 1012 or so. Remember, to see what addresses you're looking at, press f5. If you don't have the 3K expansion RAM plugged into your VIC-20, you'll see a screen full of activity here. This is the area where the 3K expander fits in. Without a 3K expander, this is neither RAM nor ROM, and the activity you see is produced by the program reading spurious values.

Press f1 again and scroll up to 4092. If you pass the desired address, you can scroll backward by pressing f3. If you don't want to waste the time scrolling, press the back-arrow, then enter 4092. On the bottom half of the screen will be many one-, two-, and three-digit numbers. You're now looking at the user BASIC program area, and the numbers you see are part of the BASIC program that POKEd this machine language routine into memory.

As you scroll through the BASIC program area and on into screen memory (7680–8191), you'll get some interesting effects. The screen may turn blank, or it may continually change, showing strange displays. This is caused by a sort of reflective effect. You're looking at screen memory while you're displaying the same memory on the screen. In effect, the screen is echoing itself. This is the same type of effect you may see when you stand in front of a three-way mirror at your local clothing store. The mirrors reflecting each other give the illusion of your reflection going off into infinity.

As you continue scrolling forward from screen memory toward 32767, you'll see the top half of the screen display one character, and the bottom half another. This area (8192–32767) is for expansion RAM, three blocks of 8K each. What you see on the screen are the page numbers of this expansion area. A page is 256 continuous bytes. For example, memory locations 8192 through 8447 would be page 32, memory locations 8448 through 8703 would be page 33, and so forth.

Looking At High Memory

Now let's save some scrolling time. Press the back-arrow, then enter 32768. What you're looking at now is the beginning of character ROM, where the VIC gets its character information. Scroll a couple of pages up to 33802, and notice the change in the screen. The characters appear to be reversed. They are. You're looking at character ROM

(33792–33815) for reversed characters.

Press the back-arrow and enter 36864. You should now see many bytes changing. This is one of the more interesting areas of the VIC to look at—input/output block O. As you scroll forward and backward through the area (36864–38400), you'll observe a lot of different activity. This input/output block is continually updating what you see on the screen. It also handles other I/O such as disk drives, printers, etc. Here, too, you'll find timers, data direction registers, and control registers. This area of the VIC-20 is always active.

The next, and last, area of memory we'll look at is 49152–65535. Press the back-arrow and enter 49152. What you see now could be called the heart of the VIC-20. The first 8000 bytes (49152–57343) is BASIC ROM, where the operating system looks when it needs to interpret BASIC commands such as PEEK, POKE, PRINT, etc. The second 8000 bytes (57344–65535) is the Kernal ROM—the true center of the VIC. Whether you're programming in BASIC or machine language, this area holds the instructions that actually tell the VIC-20 how to do those PRINTs, PEEKs, and POKEs. Without this area of the VIC, or another operating system to take its place, your VIC-20 would be a paperweight—it couldn't add 2 plus 2.

The bus is now unloading, and we hope you enjoyed the tour. It should give you an even better idea of what's going on inside that remarkable little machine of yours.

VIC Window

```
10 POKE52,28:POKE56,28:POKE251,0:CLR
                                    :rem 111
20 B=7168:C=7348:X=7196:Y=256:Z=7197
                                     :rem 3
30 FORA=BTOC:READD:POKEA,D:NEXT     :rem 29
40 SYS7168                          :rem 57
50 PRINT"{HOME}{7 SPACES}";"{HOME}{RED}";
   PEEK(X)+Y*PEEK(Z);"{BLU}"        :rem 28
60 IFPEEK(251)=1THENGOSUB100       :rem 177
70 IFPEEK(197)=64THENGOTO40        :rem 128
80 GOTO50                           :rem 6
100 POKE251,0:PRINT"{CLR}{DOWN} ENTER DES
    IRED ADDRESS":POKE198,0         :rem 78
110 INPUTN                         :rem 112
120 NN=INT(N/256):POKEX,N-(NN*256):POKEZ,
    NN                             :rem 105
130 POKE7205,PEEK(X):POKE7206,PEEK(Z)+1
                                    :rem 27
150 RETURN                         :rem 118
7168 DATA 162,0,169,6,157,0,150,232
                                    :rem 189
7176 DATA 208,250,238,6,28,173,6,28
                                    :rem 204
7184 DATA 201,152,208,236,169,150,141,6
                                    :rem 132
7192 DATA 28,162,0,189,0,0,157,0   :rem 35
7200 DATA 30,232,208,247,189,0,1,157
                                    :rem 232
7208 DATA 0,31,232,208,247,165,197,201
                                    :rem 81
7216 DATA 64,240,230,162,0,232,208,253
                                    :rem 71
7224 DATA 201,39,208,37,24,173,28,28
                                    :rem 245
7232 DATA 105,22,141,28,28,173,29,28
                                    :rem 240
7240 DATA 105,0,141,29,28,24,173,37
                                    :rem 183
7248 DATA 28,105,22,141,37,28,173,38
                                    :rem 247
7256 DATA 28,105,0,141,38,28,76,25
                                    :rem 145
7264 DATA 28,201,47,208,37,56,173,28
                                    :rem 253
7272 DATA 28,233,22,141,28,28,173,29
                                    :rem 246
7280 DATA 28,233,0,141,29,28,56,173
                                    :rem 194
7288 DATA 37,28,233,22,141,37,28,173
                                    :rem 252
7296 DATA 38,28,233,0,141,38,28,76
                                    :rem 155
7304 DATA 25,28,201,55,208,1,96,201
                                    :rem 183
7312 DATA 63,208,19,169,0,141,28,28
                                    :rem 194
7320 DATA 141,29,28,141,37,28,169,1
                                    :rem 192
7328 DATA 141,38,28,76,25,28,201,8
                                    :rem 150
7336 DATA 240,3,76,25,28,169,1,133
                                    :rem 144
7344 DATA 251,96,0,0,0              :rem 51
```

If you've got questions or ideas about subjects you'd like to see covered in this column, write to: VICreations, COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

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Commodore 64 PILOT

An advanced PILOT language for the Commodore 64 is available from Tamarack Software.

PILOT II includes 25 editing commands, 19 turtle graphics commands, and 23 program commands, with several subcommands and options.

The program includes three graphics options—lo-res turtle, hi-res turtle, and sprites. A full-featured sprite editor also is included.

A STUDENT command allows teachers to design lessons and tests and keep the answers hidden from the students. A built-in timer can track the time a student works on a problem.

PILOT II is available on disk for $49.95.

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Games For The Commodore 64

Tronix has produced four new games for play on the Commodore 64. The games, *Waterline*, *Suicide Strike*, *Motocross*, and *Slalom*, will be available initially on disk with cartridge versions to follow.

In *Waterline*, the player, a ship's captain, must choose between saving the passengers of his sinking ship or salvaging the ship's store of gold.

In *Suicide Strike*, the player flies his plane through waves of enemy planes enroute to his military target. The pilot has a limited amount of time and fuel to complete the mission. The game features a rear-view mirror that allows the player to see enemy action behind him.

Slalom and *Motocross* are graphic representations of the real sports. The games attempt to reproduce the drama and excitement found in skiing and cycle riding.

Disk versions of these games sell for $34.95; cartridge versions will be available for $39.95.

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A 16K VIC-20 expansion board with a built-in battery backup is available from Abaris.

The 16K Memory Plus includes full-block switching, a reset switch, and a write-protect switch. Also included is a Nickel-Cadmium battery backup circuit. Programs housed in the expander are retained for up to four weeks, even in the event of an unexpected power failure.

Once programs are loaded into memory, the expander can be removed and transported to another VIC. In addition, custom routines can be loaded into block 5 memory and executed automatically on power up.

The 16K Memory Plus is available for $89 plus $3 for shipping.

Abaris, Inc.
Box 2501
Vancouver, WA 98668
(206) 694-3455

Flight Simulator II *shows both the flight instrumentation and a panoramic view of the surrounding area.*

Flight Simulator For Commodore 64

Sublogic's *Flight Simulator II* puts you at the controls of a Piper 181 Cherokee Archer with full flight instrumentation and a panoramic view.

The program lets you practice takeoffs, landings, and even aerobatics. It features more than 80 airports. Day, dusk, and night flying modes are available, and

weather conditions are user adjustable.

The program, which is available for the Commodore 64 as well as Apple and Atari, also includes an air battle game that you can use to test your skills.

Flight Simulator II is available for $49.95 plus $1.50 for shipping.

Sublogic Corporation
713 Edgebrook Drive
Champaign, IL 61820
(800) 637-4983

Programs For Preschoolers

Kidbit Software has developed a line of software designed to be used by preschool children on the VIC-20.

Wormsical Count is a counting game. A worm crawls out of one of several apples on the ground and tries to make it across a field patrolled by hungry birds. Count the apples, count the birds, cheer the worm on to safety.

Small Wizard/Capital Wizard is a game that teaches the relationship between small and capital letters of the alphabet.

Same/Not Same Game teaches youngsters to match like colors, shapes, and letters. This game includes several play levels.

Alpha-Bee Sequence features a bee that sings the alphabet. When he gets stuck the child helps him along. When the alphabet is completed, the bee dances over a field of flowers to the tune of "Flight of the Bumblebee."

These programs are available on cassette for $9.95 each, two for $15.95, or four for $29.95.

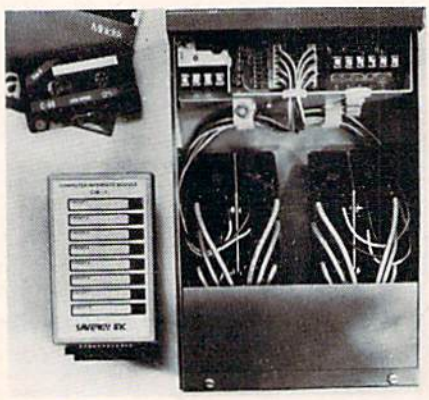
Kidbit Software
6116 Merced Ave. #175
Oakland, CA 94611

Home Computer-Appliance Interface

Savergy has produced an interface that links a Commodore 64 or VIC-20 to a variety of appliances to allow computer control of such things as lighting, heating and cooling, and lawn watering.

The Computer Interface Module 112 can communicate user-programmed information to one or more switching units having eight high- or low-voltage relays. The relay unit can be mounted up to 500 feet from the computer.

The package, which sells for $450, consists of the interface module, which plugs into the computer's User Port, a wall-mounted switching unit (about the size of a thick telephone book), and software on tape or disk.



Savergy's computer-appliance interface package consists of software, the interface module, left, and a switching unit, right.

Savergy, Inc.
1404 Webster Ave.
Fort Collins, CO 80524
(303) 221-4200

Games Converted For VIC

Sierra On-Line has converted nine of its action games for use on VIC-20 home computers.

Ultima II: Escape From Mt. Drash is an action/adventure game in which the player, a captive in the dungeons of Mt. Drash, attempts to escape through a maze of twisting subterranean corridors and tunnels. *Flip-N-Match* is a memory game in which players battle the clock while trying to match shapes. These games sell for $19.95.

In *Cannonball Blitz*, based on an American Revolution theme, the player tries to storm and overtake a Redcoat fortress. In *Jawbreaker*, players must eat their way through a horizontal maze of constantly moving walls. *Threshold* is a space shoot-em-up, complicated by overheating engines and the need to watch the fuel supply.

In *Crossfire*, the player must defend his city from aliens that approach from all directions. *Lunar Leepers* is a rescue game set on the moon. The player must save his men while avoiding the jaws of the voracious leepers. *Creepy Corridors* is a hunt for

diamonds in twisting passageways filled with crawling creatures of all sorts. These games are available for $29.95.

In *Frogger*, the player must help a frog across a busy highway and a dangerous river enroute to the peace and quiet of his home. It sells for $34.95.

Sierra On-Line, Inc.
Sierra On-Line Building
Coarsegold, CA 93614
(209) 683-6858

Software For Photographers

Shutterbug 64 is a software package designed for those who want to combine the hobbies of computing and photography.

The program, available from Quality Input, includes modules that allow the photographer to obtain detailed information on film selection, film processing, and film characteristics. The program also can create, maintain, and display photo and equipment inventory files on screen or printer.

Shutterbug 64 is available for $79.95.

Quality Input also produces several Commodore 64 programs for educational environments. They include: *Q-Stat*, a sophisticated program to assist in statistical research, $269.95; *ACT/SAT Review Package*, a program to help prepare students for college entrance examinations, $799.95; *Student Scheduler*, a program to assign student schedules in junior high and high schools, $299.95; *Student Filer*, a student record program for school administrators, $149.95; and *Learning in Spanish*, a program written in Spanish for Hispanic students, $119.95.

Quality Input, Inc.
309 West Beaufort, Suite 8
Normal, IL 61761
(309) 454-1061

Commodore 64 Tutorial

Cyberia has released the second volume of its *Commodore 64 Tutorial Series*. This program, available on disk, teaches the fundamentals of computer sound and graphics using audiovisual aids and an interactive approach.

The program, which sells for $24.95, includes a sound generator and a sprite editor, and makes extensive use of quizzes to reinforce subject matter.

Cyberia also has released *Galactic Battles*, a new Commodore 64 game. The game involves an explorer ship traveling through an alien universe dominated by robots which control time, energy, and matter. The game, which is available on disk or tape for $24.95, includes three different scenarios and ten screens.

Cyberia, Inc.
Box 784
Ames, IA 50010
(515) 292-7634

Card File For Commodore 64

Info-Manager from Pyramid Software International is an electronic index card file for the Commodore 64 designed for home or small business use.

The program, a data base, was written to resemble a traditional card file. Each record is referred to as a card, and the user has the options of searching through them or sorting them in ascending or descending order.

Command options are presented in menu format. The print option allows printing of all or part of the information in each record. In addition, any two lines of information in the record can be printed as one line.

Info-Manager is available on tape or disk for $39.95 plus $2.50 for shipping.

Another program available from Pyramid is *Memory Twister*, a computer version of the TV game show *Concentration*. *Memory Twister* comes on tape or disk for $18.95 plus $2.50 for shipping.

Pyramid Software International
30-A Fairfax St.
San Rafael, CA 94901
(415) 459-1333

COMPUTE!'s GAZETTE *welcomes announcements of new products for VIC-20 and Commodore 64 computers, especially products aimed at beginning to intermediate users. Please send press releases and photos well in advance to: Tony Roberts, Assistant Managing Editor,* COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

New product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in *COMPUTE!'s Gazette* for Commodore are written in a computer language called BASIC. BASIC is easy to learn and is built into all VIC-20s and Commodore 64s.

BASIC Programs

Each month, *COMPUTE!'s Gazette* for Commodore publishes programs for both the VIC and 64. To start out, type in only programs written for your machine, e.g., "VIC Version" if you have a VIC-20. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from another computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to "How To Type In *COMPUTE!'s Gazette* Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard and STOP key may seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, *so always SAVE a copy of your program before you RUN it*. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1) Type in the program a line at a time, in order. Press RETURN at the end of each line. Use backspace or the back arrow to correct mistakes.

2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type *COMPUTE!'s Gazette* Programs" elsewhere in the magazine.)

We regret that we are not able to respond to individual inquiries about programs, products, or services appearing in COMPUTE!'s Gazette *for Commodore due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear in the magazine, usually within eight weeks. If you have specific questions about items or programs which you've seen in* COMPUTE!'s Gazette *for Commodore, please send them to Gazette Feedback, P.O. Box 5406, Greensboro, NC 27403.*

How To Type In COMPUTE!'s Gazette Programs

Many of the programs which are listed in *COMPUTE!'s Gazette* contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to know exactly what to type when entering one of these programs into your computer, we have established the following listing conventions.

Generally, any VIC-20 or Commodore 64 program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor down key. {5 SPACES} would mean to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listings. For example, S would mean to type the S key while holding the shift key. This would appear on your screen as a "heart" symbol. If you find an underlined key enclosed in braces (e.g., {10 N}), you should type the key as many times as indicated (in our example, you would enter ten shifted N's).

If a key is enclosed in special brackets, ⟨⟩, you should hold down the *Commodore key* while pressing the key inside the special brackets. (The Commodore key is the key in the lower left corner of the keyboard.) Again, if the key is preceded by a number, you should press the key as many times as necessary.

Rarely, you'll see a solitary letter of the alphabet enclosed in braces. These characters can be entered on the Commodore 64 by holding down the CTRL key while typing the letter in the braces. For example, {A} would indicate that you should press CTRL-A. You should never have to enter such a character on the VIC-20, but if you do, you would have to leave the quote mode (press RETURN and cursor back up to the position where the control character should go), press CTRL-9 (RVS ON), the letter in braces, and then CTRL-0 (RVS OFF).

About the *quote mode*: you know that you can move the cursor around the screen with the CRSR keys. Sometimes a programmer will want to move the cursor under program control. That's why you see all the {LEFT}'s, {HOME}'s, and {BLU}'s in our programs. The only way the computer can tell the difference between direct and programmed cursor control is the quote mode.

Once you press the quote (the double quote, SHIFT-2), you are in the quote mode. If you type something and then try to change it by moving the cursor left, you'll only get a bunch of reverse-video lines. These are the symbols for cursor left. The only editing key that isn't programmable is the DEL key; you can still use DEL to back up and edit the line. Once you type another quote, you are out of quote mode.

You also go into quote mode when you INSerT spaces into a line. In any case, the easiest way to get out of quote mode is to just press RETURN. You'll then be out of quote mode and you can cursor up to the mistyped line and fix it.

Use the following table when entering cursor and color control keys:

When You Read:	Press:	See:	When You Read:	Press:	See:	When You Read:	Press:	See:
{CLEAR}	SHIFT + CLR/HOME		{CYN}	CTRL + 4		⟨7⟩	C= + 7	
{HOME}	CLR/HOME		{PUR}	CTRL + 5		⟨8⟩	C= + 8	
{UP}	SHIFT + CRSR ↕		{GRN}	CTRL + 6		{F1}	f1	
{DOWN}	CRSR ↕		{BLU}	CTRL + 7		{F2}	SHIFT + f1	
{LEFT}	SHIFT + CRSR ↔		{YEL}	CTRL + 8		{F3}	f3	
{RIGHT}	CRSR ↔		⟨1⟩	C= + 1		{F4}	SHIFT + f3	
{RVS}	CTRL + 9		⟨2⟩	C= + 2		{F5}	f5	
{OFF}	CTRL + 0		⟨3⟩	C= + 3		{F6}	SHIFT + f5	
{BLK}	CTRL + 1		⟨4⟩	C= + 4		{F7}	f7	
{WHT}	CTRL + 2		⟨5⟩	C= + 5		{F8}	SHIFT + f7	
{RED}	CTRL + 3		⟨6⟩	C= + 6				

The Automatic Proofreader

"The Automatic Proofreader" will help you type in program listings from COMPUTE!'s Gazette without typing mistakes. It is a short error-checking program that hides itself in memory. When activated, it lets you know immediately after typing a line from a program listing if you have made a mistake. Please read these instructions carefully before typing any programs in COMPUTE!'s Gazette.

Preparing The Proofreader

1. Using the listing below, type in the Proofreader. The same program works on both the VIC-20 and Commodore 64. Be very careful when entering the DATA statements — don't type an l instead of a 1, an O instead of a 0, extra commas, etc.

2. SAVE the Proofreader on tape or disk at least twice *before running it for the first time.* This is very important because the Proofreader erases this part of itself when you first type RUN.

3. After the Proofreader is SAVEd, type RUN. It will check itself for typing errors in the DATA statements and warn you if there's a mistake. Correct any errors and SAVE the corrected version. Keep a copy in a safe place — you'll need it again and again, every time you enter a program from COMPUTE!'s Gazette.

4. When a correct version of the Proofreader is RUN, it activates itself. You are now ready to enter a program listing. If you press RUN/STOP-RESTORE, the Proofreader is disabled. To reactivate it, just type the command SYS 886 and press RETURN.

Using The Proofreader

All VIC and 64 listings in COMPUTE!'s Gazette now have a *checksum number* appended to the end of each line, for example ":rem 123". *Don't enter this statement when typing in a program.* It is just for your information. The rem makes the number harmless if someone does type it in. It will, however, use up memory if you enter it, and it will confuse the Proofreader, even if you entered the rest of the line correctly.

When you type in a line from a program listing and press RETURN, the Proofreader displays a number at the top of your screen. *This checksum number must match the checksum number in the printed listing.* If it doesn't, it means you typed the line differently than the way it is listed. Immediately recheck your typing. Remember, don't type the rem statement with the checksum number; it is published only so you can check it against the number which appears on your screen.

The Proofreader is not picky with spaces. It will not notice extra spaces or missing ones. This is for your convenience, since spacing is generally not important. But occasionally proper spacing *is* important, so be extra careful with spaces, since the Proofreader will catch practically everything else that can go wrong.

There's another thing to watch out for: if you enter the line by using abbreviations for commands, the checksum will not match up. But there is a way to make the Proofreader check it. After entering the line, LIST it. This eliminates the abbreviations. Then move the cursor up to the line and press RETURN. It should now match the checksum. You can check whole groups of lines this way.

Special Tape SAVE Instructions

When you're done typing a listing, you must disable the Proofreader before SAVEing the program on tape. Disable the Proofreader by pressing RUN/STOP-RESTORE (hold down the RUN/STOP key and sharply hit the RESTORE key). This procedure is not necessary for disk SAVEs, *but you must disable the Proofreader this way before a tape SAVE.*

SAVE to tape erases the Proofreader from memory, so you'll have to LOAD and RUN it again if you want to type another listing. SAVE to disk does not erase the Proofreader.

Replace Original Proofreader

If you typed in the original version of the Proofreader (October 1983 issue), you should replace it with the improved version below. We added a POKE to the original version to protect it from being erased when you LOAD another program from tape. The POKE does protect the Proofreader, and the Proofreader itself was not affected. However, a quirk in the VIC-20's operating system means that programs typed in with the Proofreader and SAVEd on tape cannot be LOADed properly later. If you LOAD a program SAVEd while the Proofreader was in memory, you see ?LOAD ERROR. This applies only to VIC tape SAVEs (disk SAVEs work OK, and the quirk was fixed in the Commodore 64).

If you have a program typed in with the original Proofreader and SAVEd on tape, follow this special LOAD procedure:

1. Turn the power off, then on.
2. LOAD the program from tape (disregard the ?LOAD ERROR).
3. Enter: POKE 45,PEEK(174):POKE 46,PEEK(175):CLR
4. ReSAVE the program to tape.

The program will LOAD fine in the future. We strongly recommend that you type in the new version of the Proofreader and discard the old one.

Automatic Proofreader For VIC And 64

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO
    1018:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MAD
    E AN ERROR":PRINT"IN DATA STATEMENTS.
    ":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER
     ACTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

MLX Machine Language Entry Program

For Commodore 64 And VIC-20

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost failsafe entry of machine language programs published in COMPUTE!'s GAZETTE. You need to know nothing about machine language to use MLX—it was designed for everyone. There are separate versions for the Commodore 64 and expanded VIC-20 (at least 8K). MLX was conceived and written by Program Editor Charles Brannon. Important: MLX is required to type in the machine language programs in this issue.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file. You can then use the LOAD command to read the program into the computer, as with any program:

```
LOAD "filename",1,1   (for tape)
LOAD "filename",8,1   (for disk)
```

To start the program, you enter a SYS command that transfers control from BASIC to machine language. The starting SYS number always appears in the appropriate article.

Using MLX

Type in and save the correct version of MLX for your computer (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

You'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number*. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. It you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the comma, SPACE bar, or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

MLX Commands

When you finish typing an ML listing (assuming you type it all in one session) you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later. MLX recognizes these commands:

SHIFT-S: Save	**SHIFT-N: New Address**
SHIFT-L: Load	**SHIFT-D: Display**

When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command to save what you've been working on. It will save on tape or disk as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press SHIFT-N and enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

The special MLX commands may seem a bit confusing, but as you work with MLX, they will become valuable. For example, what if you forgot where you stopped typing? Use the Display command to scan memory from the beginning to the end of the program. When you reach the end of your typing, the lines will contain a random pattern of numbers. When you see the end of your typing, press any key to stop the listing. Use the New Address command to continue typing from the proper location.

You can use the Save and Load commands to make copies of the completed program. Use Load to reload the tape or disk, then insert a new tape or disk and use Save to make a new copy.

Be sure to save MLX; it will be used for future ML programs in COMPUTE!'s GAZETTE.

See program listings on page 184.

Bug-Swatter:
Modifications And Corrections

● If you used MLX to type in "Spike"(December), you may have had a problem as portions of your typing seemed to change as you entered the program. A solution is the POKE statement below, which will move the top of BASIC memory to below the Spike program, so BASIC does not write over Spike as you type it in.

POKE 52, 128: POKE 56, 128: CLR

Enter this line in direct mode (without a line number). Then LOAD and RUN MLX. Next Spike should be loaded in. By using the Display command of MLX, you can check to see which parts of Spike have been overwritten by BASIC. You can then determine which sections you need to retype.

Additionally, there is a correction in the text of the MLX article on page 164. The article mentions that by scanning memory from the beginning to the end of the program, the memory locations where you have not typed in numbers will be filled with 170s. This is incorrect. These areas will be filled with random patterns of numbers.

●"64 Basic Aid" (January) is subject to the same problem, as described above. Before typing it in, you must protect the top of memory with POKE 52,154: POKE 56,154: CLR. Without these POKEs, BASIC will overwrite the machine language program.

●Tape users have had problems using "Automatic Proofreader" with programs typed in more than one sitting (or after a safety SAVE). Automatic Proofreader is a machine language program stored in the cassette buffer, and when a program is SAVEd or LOADed from tape, the buffer is cleared. This makes it impossible to reload that part of the program you had previously entered and saved, and Automatic Proofreader at the same time.

The following modification will allow you to load Automatic Proofreader while a program is in memory:

1. LOAD and RUN Automatic Proofreader. This will put the machine language program into the cassette buffer.

2. Type the following lines in direct mode (without line numbers):

```
A$="PROOFREADER.T": B$="{10 SPACES}": FOR
   X = 1 TO 4: A$=A$+B$:NEXTX
FORX= 886 TO 1018: A$ = A$ + CHR$(PEEK(X)
  ):NEXTX
OPEN1,1,1,A$:CLOSE1
```

After you type the last line, you will be asked to press RECORD and PLAY. We recommend that you start at the beginning of a new tape.

You now have a new version of Automatic Proofreader. Turn your computer off and on, then LOAD the program you were working on. Put the cassette containing PROOFREADER.T into the tape drive and type:

OPEN1:CLOSE1

You can now get into Proofreader by typing SYS 886. To test this, PRINT PEEK (886) should return the number 173. If it does not, repeat the steps above, making sure that A$ (PROOFREADER.T) contains 13 characters and that B$ contains 10 spaces.

The new version of Automatic Proofreader will load itself into the cassette buffer whenever you type OPEN1: CLOSE1 and PROOFREADER.T is the next program on your tape. It will not disturb the contents of BASIC memory.

The lines above convert the machine language program into characters that are concatenated into a string. When you open a tape file, using the string as the name of the file, the tape header contains the ML program (disguised as the name of the file). Opening and closing the tape file loads the header into the cassette buffer, but does not disturb BASIC programs that are already in memory.

●A programming error in "64 Aardvark Attack" (November) prevents players from defending against bombs falling on city zero. To remedy this, readers James V. Powell and Sheldon S. Cantor suggest changing line 460:

```
460 IFVAL(G$)-1<>ZANDG$<>"0"ORZ<>9)THEN4
    80
```

The error was introduced when the game was translated from the VIC to the Commodore 64. The VIC-20 version (October) does not contain this problem.

●There are two typos in the Assembler program ("Machine Language For Beginners," November): In line 6060, change ZO$ to ZA$. And, in line 20000, change BCC8114 to BCC8144. Thanks to reader Jim Tobias for pointing this out.

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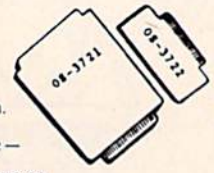

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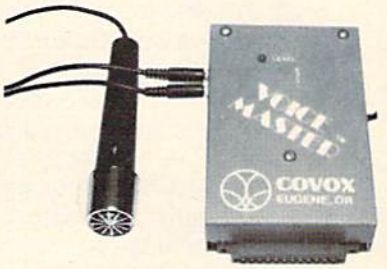

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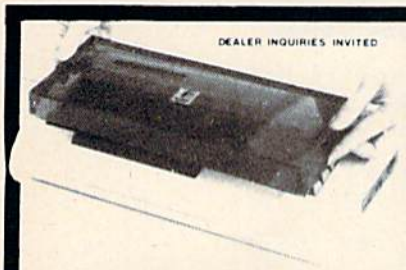

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MLX For VIC And 64

(Article on page 163.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Program 1: MLX—64 Version

```
100 PRINT"{CLR}{CYN}";CHR$(142);CHR$(8);:
    POKE53281,1:POKE53280,1          :rem 73
101 POKE 788,52:REM DISABLE RUN/STOP
                                     :rem 119
110 PRINT"{RVS}{40 SPACES}";         :rem 176
120 PRINT"{RVS}{15 SPACES}{RIGHT}{OFF}
    {*}£{RVS}{RIGHT} {RIGHT}{2 SPACES}
    {*}{OFF}{*}£{RVS}£{RVS}
    {13 SPACES}";                    :rem 250
130 PRINT"{RVS}{15 SPACES}{RIGHT} {G}
    {RIGHT} {2 RIGHT} {OFF}£{RVS}£{*}
    {OFF}{*}{RVS}{13 SPACES}";       :rem 35
140 PRINT"{RVS}{40 SPACES}"          :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK}{3 SPACES}A F
    AILSAFE MACHINE LANGUAGE EDITOR
    {5 DOWN}"                        :rem 130
210 PRINT"{5}{2 UP}STARTING ADDRESS?
    {8 SPACES}{9 LEFT}";             :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+119*F:rem 125
220 IFS<256OR(S>40960ANDS<49152)ORS>53247
    THENGOSUB3000:GOTO210            :rem 235
225 PRINT:PRINT:PRINT                :rem 180
230 PRINT"{5}{2 UP}ENDING ADDRESS?
    {8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=
    CHR$(31+119*F)                   :rem 20
240 IFE<256OR(E>40960ANDE<49152)ORE>53247
    THENGOSUB3000:GOTO230            :rem 183
250 IFE<STHENPRINTC$;"{RVS}ENDING < START
    {2 SPACES}":GOSUB1000:GOTO 230
                                     :rem 176
260 PRINT:PRINT:PRINT                :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S:POKEV+21,0
                                     :rem 225
310 PRINTRIGHT$("0000"+MID$(STR$(AD),2),5
    );":";:FORJ=1TO6                 :rem 234
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                     :rem 228
390 IFN=-211THEN 710                 :rem 62
400 IFN=-204THEN 790                 :rem 64
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER N
    EW ADDRESS";ZZ                   :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"
    {RVS}OUT OF RANGE":GOSUB1000:GOTO410
                                     :rem 225
417 IFN=-206THENAD=ZZ:PRINT:GOTO310
                                     :rem 238
420 IF N<>-196 THEN 480              :rem 133
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO
    ";:INPUTT                        :rem 234
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAS
    T";S;"{LEFT}, NOT MORE THAN";E:GOTO43
    0                                :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("000
    0"+MID$(STR$(I),2),5);":";       :rem 30
```

```
451 FORK=0TO5:N=PEEK(I+K):PRINTRIGHT$("00
    "+MID$(STR$(N),2),3);",";      :rem 66
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
                                   :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRIN
    T:GOTO310                      :rem 50
480 IFN<0 THEN PRINT:GOTO310       :rem 168
490 A(J)=N:NEXTJ                   :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
    SUM=(CKSUM+A(I))AND255:NEXT    :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(20)
                                   :rem 234
515 IFN=CKSUMTHEN530               :rem 255
520 PRINT:PRINT"LINE ENTERED WRONG : RE-E
    NTER":PRINT:GOSUB1000:GOTO310:rem 176
530 GOSUB2000                      :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE54
    272,0:POKE54273,0              :rem 227
550 AD=AD+6:IF AD<E THEN 310       :rem 212
560 GOTO 710                       :rem 108
570 N=0:Z=0                        :rem 88
580 PRINT"{+}";                    :rem 79
581 GETA$:IFA$=""THEN581           :rem 95
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44
    ORA=32THEN670                  :rem 229
590 IFA>128THENN=-A:RETURN         :rem 137
600 IFA<>20 THEN 630               :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {LEFT} {LEFT}";:GOTO690        :rem 172
620 GOTO570                        :rem 109
630 IFA<48ORA>57THEN580            :rem 105
640 PRINTA$;:N=N*10+A-48           :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                   :rem 229
660 Z=Z+1:IFZ<3THEN580             :rem 71
670 IFZ=0THENGOSUB1000:GOTO570     :rem 114
680 PRINT",";:RETURN               :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                   :rem 149
691 FORI=1TO3:T=PEEK(S%-I)         :rem 67
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                   :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                   :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                   :rem 236
720 INPUT"{DOWN} FILENAME";F$      :rem 228
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
     {RVS}D{OFF}ISK: (T/D)"        :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
                                   :rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                   :rem 158
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256               :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                   :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                             :rem 69
765 POKE254,S/256:POKE253,S-PEEK(254)*256
    :POKE780,253                   :rem 12
766 POKE782,E/256:POKE781,E-PEEK(782)*256
    :SYS65496                      :rem 124
770 IF(PEEK(783)AND1)OR(ST AND191)THEN780
                                   :rem 111
775 PRINT"{DOWN}DONE.":END         :rem 106
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
    RY AGAIN.":IFDV=1THEN720       :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO720           :rem 103
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                   :rem 212
800 INPUT"{2 DOWN} FILENAME";F$    :rem 244
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
     {RVS}D{OFF}ISK: (T/D)"        :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820
                                   :rem 34
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                   :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256               :rem 2
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                   :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                             :rem 70
850 POKE780,0:SYS65493             :rem 11
860 IF(PEEK(783)AND1)OR(ST AND191)THEN870
                                   :rem 111
865 PRINT"{DOWN}DONE.":GOTO310     :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
                                   :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO800           :rem 102
1000 REM BUZZER                    :rem 135
1001 POKE54296,15:POKE54277,45:POKE54278,
     165                           :rem 207
1002 POKE54276,33:POKE 54273,6:POKE54272,
     5                             :rem 42
1003 FORT=1TO200:NEXT:POKE54276,32:POKE54
     273,0:POKE54272,0:RETURN      :rem 202
2000 REM BELL SOUND                :rem 78
2001 POKE54296,15:POKE54277,0:POKE54278,2
     47                            :rem 152
2002 POKE 54276,17:POKE54273,40:POKE54272
     ,0                            :rem 86
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
                                   :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
     GOTO1000                      :rem 89
```

Program 2: MLX—VIC Version

```
100 PRINT"{CLR}{PUR}";CHR$(142);CHR$(8);
                                   :rem 181
101 POKE 788,194:REM DISABLE RUN/STOP
                                   :rem 174
110 PRINT"{RVS}{14 SPACES}"        :rem 117
120 PRINT"{RVS} {RIGHT}?{OFF}{*}£{RVS}
    {RIGHT} {RIGHT}{2 SPACES}{*}{OFF}
    {*}£{RVS}£{RVS} "              :rem 191
130 PRINT"{RVS} {RIGHT} {G}{RIGHT}
    {2 RIGHT} {OFF}£{RVS}£{*}{OFF}
    {*}{RVS} "                     :rem 232
140 PRINT"{RVS}{14 SPACES}"        :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK}A FAILSAFE MA
    CHINE":PRINT"LANGUAGE EDITOR{5 DOWN}"
                                   :rem 141
210 PRINT"{BLK}{3 UP}STARTING ADDRESS":IN
    PUTS:F=1-F:C$=CHR$(31+119*F)   :rem 97
220 IFS<256ORS>32767THENGOSUB3000:GOTO210
                                   :rem 2
225 PRINT:PRINT:PRINT:PRINT        :rem 123
230 PRINT"{BLK}{3 UP}ENDING ADDRESS":INPU
    TE:F=1-F:C$=CHR$(31+119*F)     :rem 158
240 IFE<256ORE>32767THENGOSUB3000:GOTO230
                                   :rem 234
250 IFE<STHENPRINTC$;"{RVS}ENDING < START
    {2 SPACES}":GOSUB1000:GOTO 230
                                   :rem 176
260 PRINT:PRINT:PRINT              :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S     :rem 56
```

```
310 PRINTRIGHT$("0000"+MID$(STR$(AD),2),5
    );":";:FORJ=1TO6                    :rem 234
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                        :rem 228
390 IFN=-211THEN 710                    :rem 62
400 IFN=-204THEN 790                    :rem 64
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER N
    EW ADDRESS";ZZ                      :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"
    {RVS}OUT OF RANGE":GOSUB1000:GOTO410
                                        :rem 225
417 IFN=-206THENAD=ZZ:PRINT:GOTO310
                                        :rem 238
420 IF N<>-196 THEN 480                 :rem 133
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO
    ";:INPUTT                           :rem 234
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAS
    T";S;"{LEFT}, NOT MORE THAN",E:GOTO43
    0                                   :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("000
    0"+MID$(STR$(I),2),5);":";          :rem 30
455 FORK=0TO5:N=PEEK(I+K):IFK=3THENPRINTS
    PC(10);                             :rem 34
457 PRINTRIGHT$("00"+MID$(STR$(N),2),3);"
    ,";                                 :rem 157
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
                                        :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRIN
    T:GOTO310                           :rem 50
480 IFN<0 THEN PRINT:GOTO310            :rem 168
490 A(J)=N:NEXTJ                        :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
    SUM=(CKSUM+A(I))AND255:NEXT         :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(20)
                                        :rem 234
515 IFN=CKSUMTHEN530                    :rem 255
520 PRINT:PRINT"LINE ENTERED WRONG":PRINT
    "RE-ENTER":PRINT:GOSUB1000:GOTO310
                                        :rem 129
530 GOSUB2000                           :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:rem 80
550 AD=AD+6:IF AD<E THEN 310            :rem 212
560 GOTO 710                            :rem 108
570 N=0:Z=0                             :rem 88
580 PRINT"[+]";                         :rem 79
581 GETA$:IFA$=""THEN581                :rem 95
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44
    ORA=32THEN670                       :rem 229
590 IFA>128THENN=-A:RETURN              :rem 137
600 IFA<>20 THEN 630                    :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {LEFT} {LEFT}";:GOTO690             :rem 172
620 GOTO570                             :rem 109
630 IFA<48ORA>57THEN580                 :rem 105
640 PRINTA$;:N=N*10+A-48                :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                        :rem 229
660 Z=Z+1:IFZ<3THEN580                  :rem 71
670 IFZ=0THENGOSUB1000:GOTO570          :rem 114
680 PRINT",";:RETURN                    :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                        :rem 149
692 FORI=1TO3:T=PEEK(S%-I)              :rem 68
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                        :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                        :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                        :rem 236
720 INPUT"{DOWN} FILENAME";F$           :rem 228
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"              :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
                                        :rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                        :rem 158
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                    :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                        :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                                  :rem 69
765 POKE254,S/256:POKE253,S-PEEK(254)*256
    :POKE780,253                        :rem 12
766 POKE782,E/256:POKE781,E-PEEK(782)*256
    :SYS65496                           :rem 124
770 IF(PEEK(783)AND1)OR(ST AND191)THEN780
                                        :rem 111
775 PRINT"{DOWN}DONE.":END              :rem 106
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
    RY AGAIN.":IFDV=1THEN720            :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO720                :rem 103
782 GOTO720                             :rem 115
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                        :rem 212
800 INPUT"{2 DOWN} FILENAME";F$         :rem 244
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"              :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820
                                        :rem 34
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                        :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                    :rem 2
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                        :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                                  :rem 70
850 POKE780,0:SYS65493                  :rem 11
860 IF(PEEK(783)AND1)OR(ST AND191)THEN870
                                        :rem 111
865 PRINT"{DOWN}DONE.":GOTO310          :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
                                        :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO800                :rem 102
1000 REM BUZZER                         :rem 135
1001 POKE36878,15:POKE36874,190         :rem 206
1002 FORW=1TO300:NEXTW                  :rem 117
1003 POKE36878,0:POKE36874,0:RETURN
                                        :rem 74
2000 REM BELL SOUND                     :rem 78
2001 FORW=15TO0STEP-1:POKE36878,W:POKE368
    76,240:NEXTW                        :rem 22
2002 POKE36876,0:RETURN                 :rem 119
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
    GOTO1000                            :rem 89
```

Speed Reader

(Article on page 82.)

Program 1:

Speed Reader — 64 Version

```
10 POKE 53280,15 : POKE 53281,15 : REM SE
   T BORDER AND BACKGROUND COLORS:rem 111
20 PRINT "{WHT}"                        :rem 56
```

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

```
30 CL = 55776 : REM START OF SCREEN COLOR
   MEMORY                              :rem 150
40 DD = 50 : NC = 5 : REM VARIABLES FOR D
   ELAY & NUMBER OF DISPLAYED CHARACTER
                                       :rem 136
50 PRINT "{CLR}" : REM CLEAR SCREEN
                                       :rem 14
60 FOR I = 1 TO 4 : PRINT : NEXT I
                                       :rem 100
70 PRINT TAB(14) "SPEED READER"        :rem 233
80 PRINT : PRINT : PRINT               :rem 131
90 PRINT"HOLD DOWN THESE KEYS TO CHANGE D
   ISPLAY"                             :rem 173
100 PRINT : PRINT "{3 SPACES}F - MAKES RE
    ADING SPEED FASTER"                :rem 61
110 PRINT : PRINT "{3 SPACES}S - MAKES RE
    ADING SPEED SLOWER"                :rem 98
120 PRINT : PRINT "{3 SPACES}> - DISPLAYS
     MORE CHARACTERS ON LINE"          :rem 215
130 PRINT : PRINT "{3 SPACES}< - DISPLAYS
     FEWER CHARACTERS ON LINE";        :rem 87
140 PRINT : PRINT "{3 SPACES}Q - QUIT THE
     PROGRAM"                          :rem 231
150 PRINT : PRINT : PRINT              :rem 177
160 PRINT "PRESS SPACEBAR TO START THE SP
    EED READER":PRINT                  :rem 51
170 S=PEEK(197):IFS<>60ANDS<>62THEN170
                                       :rem 10
175 IFS=62THEN60000                    :rem 73
180 POKE 788,52 : REM DISABLE STOP KEY
                                       :rem 67
190 PRINT "{8}"                        :rem 6
200 READ A$                            :rem 19
210 IF A$ = "EOD" THEN GOTO 60000      :rem 62
230 PRINT"{CLR}{12 DOWN}"A$            :rem 42
240 FOR L = 0 TO 39                    :rem 69
250 POKE CL + L,12 : REM POKE CONTRASTING
     COLOR FOR EACH LETTER IN LINE
                                       :rem 250
260 IF L - NC >= 0 THEN POKE CL + L - NC,
    15 : REM POKE BACK TO BACKGROUND COLO
    R                                  :rem 240
270 FOR D = 0 TO DD : NEXT D           :rem 25
280 NEXT L                             :rem 37
290 S = PEEK(197) : REM SCAN KEYBOARD FOR
     KEYPRESS                          :rem 51
300 IF S = 21 THEN DD = DD - 10 : REM DEC
    REASE DELAY - READ FASTER          :rem 246
310 IF S = 13 THEN DD = DD + 10 : REM INC
    REASE DELAY - READ SLOWER          :rem 27
320 IF S = 44 THEN NC = NC + 2 : IF NC >
    {SPACE}11 THEN NC = NC - 2         :rem 238
330 REM LINE 320 INCREASES THE NUMBER OF
    {SPACE}CHARACTERS DISPLAYED AT ONE TI
    ME                                 :rem 56
340 IF S = 47 THEN NC = NC - 2 : IF NC <
    {SPACE}3 THEN NC = NC + 2          :rem 194
350 REM LINE 340 DECREASES THE NUMBER OF
    {SPACE}CHARACTERS DISPLAYED AT ONE TI
    ME                                 :rem 46
360 IF S = 62 THEN GOTO 60000 : REM END T
    HE PROGRAM                         :rem 108
370 GOTO 200                           :rem 101
400 REM ** TRY THIS SAMPLE DATA - THEN SU
    BSTITUTE YOUR OWN SELECTION{2 SPACES}
    **                                 :rem 148
410 DATA "{2 SPACES}THIS IS A SAMPLE OF T
    HE SPEED READING"                  :rem 171
420 DATA "PROGRAM FOR THE COMMODORE 64.
    {2 SPACES}YOU CAN"                 :rem 224
430 DATA "PUT ANY KIND OF READING MATERIA
    L IN THE"                          :rem 82
440 DATA "DATA STATEMENTS, AND THE COMPUT
    ER WILL"                           :rem 159
450 DATA "DISPLAY ONE LINE AT A TIME FROM
     LEFT TO"                          :rem 30
460 DATA "RIGHT FORCING YOU TO READ WITH
    {SPACE}THE"                        :rem 87
470 DATA "CORRECT EYE HABITS.{2 SPACES}WI
    TH ENOUGH"                         :rem 217
480 DATA "PRACTICE, IT IS POSSIBLE TO DOU
    BLE OR"                            :rem 10
490 DATA "TRIPLE YOUR READING SPEED.
    {2 SPACES}IN THIS"                 :rem 130
500 DATA "PROGRAM YOU CAN USE THE KEYBOAR
    D TO"                              :rem 156
510 DATA "INCREASE YOUR READING RATE WITH
     THE (F)"                          :rem 103
520 DATA "KEY, OR YOU CAN SLOW DOWN THE P
    ROGRAM"                            :rem 240
530 DATA "WITH THE (S) KEY."           :rem 206
540 DATA "{3 SPACES}IF YOU WANT TO SEE MO
    RE WORDS ON THE"                   :rem 125
550 DATA "LINE, HOLD DOWN THE > KEY.
    {2 SPACES}THE <"                   :rem 254
560 DATA "KEY SHOWS FEWER CHARACTERS ON T
    HE LINE AT"                        :rem 10
570 DATA "ONE TIME.{2 SPACES}WHEN YOU ARE
     READY TO QUIT,"                   :rem 199
580 DATA "JUST PRESS THE (Q) KEY."
                                       :rem 104
590 DATA "{2 SPACES}THIS PROGRAM DUPLICAT
    ES SOME OF THE"                    :rem 228
600 DATA "SAME TECHNIQUES USED IN REGULAR
     SPEED"                            :rem 94
610 DATA "READING CLASSES.{2 SPACES}BECAU
    SE WE ARE TRYING"                  :rem 116
620 DATA "TO CORRECT EYE MOVEMENT HABITS,
     WE WILL"                          :rem 180
630 DATA "HAVE TO DEVOTE SOME AMOUNT OF P
    RACTICE"                           :rem 109
640 DATA "TO COR"{RVS}CTING OUR BAD HABIT
    S, BUT THE"                        :rem 152
650 DATA "READING EXPERTS SEE NO REASON W
    HY WE"                             :rem 244
660 DATA "CANNOT MAKE OURSELVES BETTER AN
    D FASTER"                          :rem 1
670 DATA "READERS IF WE WORK TOWARD THAT
    {SPACE}GOAL."                      :rem 194
60000 POKE198,0:POKE 788,49 : REM ENABLE
      {SPACE}THE STOP KEY              :rem 161
60010 PRINT "{CLR}"                    :rem 91
60020 PRINT "{WHT}"                    :rem 206
60030 DATA "EOD"                       :rem 47
```

Program 2:
Speed Reader — VIC Version

```
5 POKE 808,114:REM DISABLE STOP KEY:rem 7
10 POKE 36879,110:REM SET BORDER AND BACK
   GROUND COLORS                       :rem 172
20 PRINT "{WHT}"                       :rem 56
```

```
30 CL = 38576:REM START OF SCREEN COLOR M
   EMORY                              :rem 149
40 DD=50:NC=3:REM VARIABLES FOR DELAY AND
    NUMBER OF DISPLAYED CHARACTERS
                                      :rem 134
50 PRINT"{CLR}":REM CLEAR SCREEN     :rem 14
60 FORI=1TO4:PRINT:NEXTI             :rem 100
70 PRINTTAB(3)"**SPEED READER**"     :rem 95
80 PRINT:PRINT                       :rem 188
90 PRINT"HOLD DOWN KEY:"             :rem 188
100 PRINT:PRINT"{RVS}F{OFF}-FOR FAST READ
    ING{6 SPACES}SPEED"              :rem 192
110 PRINT:PRINT "{RVS}S{OFF}-FOR SLOW REA
    DING{6 SPACES}SPEED"             :rem 229
120 PRINT: PRINT"{RVS}>{OFF}-FOR MORE CHA
    RACTERS{3 SPACES}ON LINE"        :rem 249
130 PRINT:PRINT"{RVS}<{OFF}-FOR FEWER CHA
    RACTERS{2 SPACES}ON LINE"        :rem 62
140 PRINT:PRINT"{RVS}Q{OFF}-QUIT THE PROG
    RAM"                             :rem 139
150 PRINT:PRINT                      :rem 234
160 PRINT"{2 RIGHT}{YEL}{RVS}{RIGHT}SPACE
    BAR TO START{OFF}"               :rem 115
170 S=PEEK(197):IFS<>32ANDS<>48THEN170
                                      :rem 13
175 IFS=48THEN60000                   :rem 77
190 POKE36879,59                     :rem 116
200 READA$                            :rem 19
210 IFA$="EOD"THEN60000               :rem 5
230 PRINT"{CYN}{CLR}{8 DOWN}"A$      :rem 133
240 FORL=0TO21                        :rem 60
250 POKECL+L,0:REM POKE CONTRASTING COLOR
     FOR EACH LETTER IN LINE         :rem 199
260 IFL-NC>=0THEN POKECL+L-NC,3:REM POKE
    {SPACE}BACK TO BACKGROUND COLOR
                                      :rem 189
270 FORD=0TODD:NEXT D                 :rem 25
280 NEXT L                            :rem 37
290 S=PEEK(197):REM SCAN KEYBOARD FOR KEY
    PRESS                             :rem 51
300 IFS=42THENDD=DD-10:REM DECREASE DELAY
    -READ FASTER                     :rem 249
310 IFS=41THENDD=DD+10:REM INCREASE DELAY
    -READ SLOWER                      :rem 28
320 IFS=37THENNC=NC+2:IFNC>11THENNC=NC-2
                                      :rem 240
330 REM LINE 320 INCREASES THE NUMBER OF
    {SPACE}CHARACTERS DISPLAYED AT ONE TI
    ME                                :rem 56
340 IFS=29THENNC=NC-2:IFNC<3THENNC=NC+2
                                      :rem 194
350 REM LINE 340 DECREASES THE NUMBER OF
    {SPACE}CHARACTERS DISPLAYED AT ONE TI
    ME                                :rem 46
360 IFS=48THEN60000:REM END THE PROGRAM
                                      :rem 55
370 GOTO200                          :rem 101
400 REM ** TRY THIS SAMPLE DATA - THEN SU
    BSTITUTE YOUR OWN SELECTION{2 SPACES}
    **                                :rem 148
410 DATA "{2 SPACES}THIS IS A SAMPLE OF"
                                      :rem 95
415 DATA"THE SPEED READING"           :rem 68
420 DATA"PROGRAM FOR THE VIC-20"      :rem 69
425 DATA". YOU CAN PUT ANY KIND"     :rem 253
430 DATA " OF READING MATERIAL"      :rem 211
435 DATA" IN THE DATA"               :rem 140
440 DATA " STATEMENTS, AND THE"      :rem 222
445 DATA" COMPUTER WILL DISPLAY"     :rem 184
450 DATA " ONE LINE AT A TIME"         :rem 6
455 DATA" FROM LEFT TO RIGHT"        :rem 124
460 DATA " FORCING YOU TO READ"      :rem 188
465 DATA" WITH THE CORRECT EYE"       :rem 15
470 DATA "HABITS. WITH ENOUGH"       :rem 228
480 DATA "PRACTICE, IT IS "          :rem 170
485 DATA"POSSIBLE TO DOUBLE OR"       :rem 95
490 DATA "TRIPLE YOUR READING "       :rem 20
495 DATA"SPEED. IN THIS PROGRAM"     :rem 134
500 DATA " YOU CAN USE THE "         :rem 144
505 DATA"KEYBOARD TO INCREASE"        :rem 54
510 DATA " YOUR READING RATE "       :rem 105
515 DATA"WITH THE (F) KEY, OR"        :rem 99
520 DATA " YOU CAN SLOW DOWN THE "   :rem 34
525 DATA"PROGRAM"                     :rem 18
530 DATA "WITH THE (S) KEY."         :rem 206
540 DATA "{3 SPACES}IF YOU WANT TO SEE "
                                      :rem 61
545 DATA"MORE WORDS ON THE LINE"     :rem 100
550 DATA ", HOLD DOWN THE > KEY. "
                                      :rem 185
555 DATA"THE < KEY SHOWS FEWER"       :rem 16
560 DATA " CHARACTERS ON THE "        :rem 87
565 DATA"LINE AT ONE TIME. WHEN"      :rem 44
570 DATA " YOU ARE READY TO QUIT"     :rem 42
580 DATA ", JUST PRESS THE (Q) "     :rem 125
585 DATA"KEY. THIS PROGRAM "         :rem 103
590 DATA "DUPLICATES SOME OF THE"    :rem 148
600 DATA "SAME TECHNIQUES USED "      :rem 68
605 DATA"IN REGULAR SPEED"            :rem 19
610 DATA " READING CLASSES. "         :rem 43
615 DATA"BECAUSE WE ARE TYPING "      :rem 65
620 DATA "TO CORRECT EYE "           :rem 142
625 DATA"MOVEMENT HABITS, WE "       :rem 233
630 DATA "HAVE TO DEVOTE SOME "      :rem 185
635 DATA"AMOUNT OF PRACTICE "        :rem 176
640 DATA "TO CORRECTING OUR BAD "     :rem 72
645 DATA"HABITS, BUT THE"            :rem 176
650 DATA "READING EXPERTS SEE NO"    :rem 152
655 DATA" REASON WHY WE CANNOT "      :rem 29
660 DATA "MAKE OURSELVES BETTER "    :rem 166
665 DATA"AND FASTER READERS IF "      :rem 44
670 DATA "WE WORK TOWARD THAT "      :rem 220
675 DATA"GOAL."                       :rem 81
60000 POKE198,0:POKE 808,112:REM ENABLE T
      HE STOP KEY                    :rem 193
60010 PRINT"{CLR}"                    :rem 91
60020 PRINT"{BLK}"                    :rem 89
60030 DATA"EOD"                       :rem 47
```

VIC Piano

(Article on page 94.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

```
10 POKE36879,106:PRINT"{CLR}{BLK}";
                                      :rem 205
12 PRINT"{RVS}{YEL}{6 SPACES}VIC
   {2 SPACES}PIANO{28 SPACES}";  :rem 120
20 PRINT"{RVS}{WHT}G{BLK} {WHT}A{BLK}
   {WHT}BC{BLK} {WHT}D{BLK} {WHT}EF{BLK}
   {SPACE}{WHT}G{BLK} {WHT}A{BLK} {WHT}BC
   {BLK} {WHT}D{BLK} {WHT}E";     :rem 52
25 FORT=1TO4                          :rem 231
```

```
30 PRINT"{RVS}{WHT} {BLK} {WHT} {BLK}
   {WHT} {G} {BLK} {WHT} {BLK} {WHT}
   {G} {BLK} {WHT} {BLK} {WHT} {BLK}
   {WHT} {G} {BLK} {WHT} {BLK} {WHT} ";
                                  :rem 178
40 NEXTT                          :rem 247
50 FORT=1TO3                      :rem 228
60 PRINT"{RVS}{WHT} _ _ {G}_ _ {G}_ _
   _ {G}_ _ {OFF}";               :rem 207
70 NEXT                           :rem 166
75 PRINT"{DOWN}{WHT} 2 3{2 SPACES}5 6
   {2 SPACES}8 9 0{2 SPACES}- £ ";
                                  :rem 136
80 PRINT"Q W ER T YU I O P@ * ↑";:rem 101
100 PRINT"{5 DOWN}";              :rem 242
110 PRINT"PLAY EACH NOTE BY THE CHARACTER
    S ABOVE.";                    :rem 18
120 PRINT"PRESS{2 SPACES}SPACE BAR TO RES
    T."                           :rem 65
160 DIM N(55),J(55)               :rem 171
170 FOR I=0 TO 55:J(I)=264:N(I)=0:NEXT I:
    XX=55                         :rem 27
180 FOR I=0 TO 21:READ K,M:J(K-42)=I:N(K-
    42)=M:NEXT I                  :rem 146
190 POKE36878,15                  :rem 107
400 GETA$:IFA$=""THEN400          :rem 75
420 X=ASC(A$)-42:IF X<0 OR X>55 THEN X=55
                                  :rem 167
430 POKE7900+J(XX),32             :rem 157
440 POKE36876,0                   :rem 49
450 POKE36876,N(X)                :rem 249
460 XX=X                          :rem 223
470 POKE7900+J(X),81              :rem 77
480 GOTO400                       :rem 105
800 DATA 81,175,50,179,87,183,51,187
                                  :rem 3
810 DATA 69,191,82,195,53,198,84,201,54,2
    04                            :rem 90
820 DATA 89,207,85,210,56,212,73,215,57,2
    17,79,219,48,221              :rem 15
830 DATA 80,223,64,225,45,227,42,228,92,2
    29,94,231                     :rem 172
```

Checkers

(Article on page 90.)

```
100 DIMX(4),S(7,7):G=-1:X(0)=-99:PRINT"
    {BLK}{CLR}"                   :rem 235
101 SYS65517:IFPEEK(781)=40THEN103
                                  :rem 220
102 POKE36879,59:GOTO110          :rem 114
103 POKE53280,3:POKE53281,3       :rem 239
110 DATA1,0,1,0,0,0,-1,0,0,1,0,0,0,-1,0,-
    1,15                          :rem 95
120 A$="{19 SPACES}":B$="{HOME}{12 DOWN}"
                                  :rem 121
130 FORX=0TO7:FORY=0TO7:READJ:IFJ=15THEN1
    50                            :rem 246
140 S(X,Y)=J:GOTO160              :rem 167
150 RESTORE:READS(X,Y)            :rem 145
160 NEXTY,X:PRINT"{CLR}";         :rem 140
170 FORX=0TO7:FORY=0TO7:IFS(X,Y)>-1THEN20
    0                             :rem 134
180 IFS(X,Y)=-1THENFORA=-1TO1STEP2:B=G:GO
    SUB210:NEXTA                  :rem 127
190 IFS(X,Y)=-2THENFORA=-1TO1STEP2:FORB=-
    1TO1STEP2:GOSUB210:NEXTB,A    :rem 47
200 NEXTY,X:GOTO370               :rem 187
210 U=X+A:V=Y+B:IFU<0ORU>7ORV<0ORV>7THEN2
    60                            :rem 7
220 IFS(U,V)=0THENGOSUB270:GOTO260:rem 94
230 IFS(U,V)<0THEN260             :rem 210
240 U=U+A:V=V+B:IFU<0ORV<0ORU>7ORV>7THEN2
    60                            :rem 4
250 IFS(U,V)=0THENGOSUB270        :rem 86
260 RETURN                        :rem 120
270 IFV=0ANDS(X,Y)=-1THENQ=Q+2    :rem 69
280 IFABS(Y-V)=2THENQ=Q+5         :rem 9
290 IFY=7THENQ=Q-2                :rem 100
300 IFY=0ORU=7THENQ=Q+1           :rem 188
310 FORC=-1TO1STEP2:IFU+C<0ORU+C>7ORV+G<0
    THEN350                       :rem 8
320 IFS(U+C,V+G)<0THENQ=Q+1:GOTO350
                                  :rem 96
330 IFU-C<0ORU-C>7ORV-G>7THEN350  :rem 216
340 IFS(U+C,V+G)>0AND(S(U-C,V-G)=0OR(U-C=
    XANDV-G=Y))THENQ=Q-2          :rem 203
350 NEXTC:IFQ>X(0)THENX(0)=Q:X(1)=X:X(2)=
    Y:X(3)=U:X(4)=V               :rem 135
360 Q=0:RETURN                    :rem 113
370 IFX(0)=-99THEN1040            :rem 210
380 GOSUB1060:PRINT"ME"X(1);","X(2)"TO"X(
    3)","X(4):X(0)=-99            :rem 222
390 FORXX=1TO400:NEXTXX           :rem 1
400 IFX(4)=0THENS(X(3),X(4))=-2:GOTO420
                                  :rem 202
410 S(X(3),X(4))=S(X(1),X(2))     :rem 224
420 S(X(1),X(2))=0:IFABS(X(1)-X(3))<>2THE
    N510                          :rem 204
430 S((X(1)+X(3))/2,(X(2)+X(4))/2)=0
                                  :rem 252
440 X=X(3):Y=X(4):IFS(X,Y)=-1THENB=-2:FOR
    A=-2TO2STEP4:GOSUB480         :rem 65
450 IFS(X,Y)=-2THENFORA=-2TO2STEP4:FORB=-
    2TO2STEP4:GOSUB480:NEXTB      :rem 210
460 NEXTA:IFX(0)<>-99THENPRINT"TO"X(3)","
    X(4);:X(0)=-99:GOTO400        :rem 210
470 GOTO510                       :rem 106
480 U=X+A:V=Y+B:IFU<0ORU>7ORV<0ORV>7THEN5
    00                            :rem 13
490 IFS(U,V)=0ANDS(X+A/2,Y+B/2)>0THENGOSU
    B270                          :rem 185
500 RETURN                        :rem 117
505 FORI=1TO25:PRINT:NEXT         :rem 130
510 PRINT"{BLK}{HOME} ROW":PRINT"{BLK}
    {2 SPACES}{D}{8 I}{F}":FORY=7TO
    0STEP-1:PRINTY;"{LEFT}{RVS}{K}{OFF}
    ";:FORX=0TO7                  :rem 235
520 IFS(X,Y)=0THENIF(X+Y)/2=INT((X+Y)/2)T
    HENPRINT"{RVS} {OFF}";:GOTO580:rem 86
530 IFS(X,Y)=0THENPRINT" ";       :rem 80
540 IFS(X,Y)=1THENPRINT"{RVS}Q{OFF}";:GOT
    O580                          :rem 215
550 IFS(X,Y)=-1THENPRINT"{RVS}W{OFF}";:GO
    TO580                         :rem 11
560 IFS(X,Y)=-2THENPRINT"*";:GOTO580
                                  :rem 188
570 IFS(X,Y)=2THENPRINT"{RVS}*{OFF}";
                                  :rem 36
580 NEXTX:PRINT"{K}":NEXTY:PRINT"
    {2 SPACES}{C}{RVS}{8 I}{OFF}{V}
    ":PRINT"{3 SPACES}01234567 COL"
                                  :rem 112
590 GOSUB1060:PRINT"FROM";        :rem 95
600 GETG$:IFG$=""THEN600          :rem 91
610 IFG$<"0"ORG$>"7"THEN590       :rem 211
620 E=VAL(G$):PRINTE;",";         :rem 17
630 GETG$:IFG$=""THEN630          :rem 9
640 IFG$<"0"ORG$>"7"THEN590       :rem 214
650 H=VAL(G$):PRINTH              :rem 206
```

```
660 X=E:Y=H:IFS(X,Y)<=0THEN590      :rem 78
670 PRINT"TO";                      :rem 76
680 GETG$:IFG$=""THEN680            :rem 107
690 IFG$<"0"ORG$>"7"THEN670         :rem 218
700 A=VAL(G$):PRINTA;",";           :rem 162
710 GETG$:IFG$=""THEN710            :rem 95
720 IFG$<"0"ORG$>"7"THEN670         :rem 212
730 B=VAL(G$):PRINTB                :rem 193
740 X=A:Y=B                         :rem 131
750 IFS(X,Y)=0ANDABS(A-E)<=2ANDABS(A-E)=A
    BS(B-H)THEN770                  :rem 6
760 GOTO590                         :rem 116
770 I=46                            :rem 142
780 S(A,B)=S(E,H):S(E,H)=0:IFABS(E-A)<>2T
    HEN910                          :rem 168
790 S((E+A)/2,(H+B)/2)=0            :rem 167
800 PRINT"+TO";                     :rem 114
810 GETG$:IFG$=""THEN810            :rem 97
820 IFG$=CHR$(13)THEN910            :rem 80
830 IFG$<"0"ORG$>"7"THEN810         :rem 210
840 A1=VAL(G$):PRINTA1;",";          :rem 9
850 GETG$:IFG$=""THEN850            :rem 105
860 IFG$=CHR$(13)THEN910            :rem 84
870 IFG$<"0"ORG$>"7"THEN850         :rem 218
880 B1=VAL(G$):PRINTB1              :rem 41
890 IFS(A1,B1)<>0ORABS(A1-A)<>2ORABS(B1-B
    )<>2THEN800                     :rem 0
900 E=A:H=B:A=A1:B=B1:I=I+15:GOTO780
                                    :rem 95
910 IFB=7THENS(A,B)=2               :rem 208
920 PRINT"{HOME}{11 DOWN}{3 RIGHT}0123456
    7 COL"                          :rem 11
930 PRINT"{2 UP}{2 SPACES}{C}{RVS}
    {8 I}{OFF}{V}{2 UP}"      :rem 223
940 FORY=0TO7:PRINTY;"{LEFT}{RVS}{K}
    {OFF}";:FORX=0TO7               :rem 160
950 IFS(X,Y)=0THENIF(X+Y)/2=INT((X+Y)/2)T
    HENPRINT"{RVS} {OFF}";:GOTO1010
                                    :rem 130
960 IFS(X,Y)=0THENPRINT" ";:GOTO1010
                                    :rem 140
970 IFS(X,Y)=1THENPRINT"{RVS}Q{OFF}";:GOT
    O1010                           :rem 3
980 IFS(X,Y)=-1THENPRINT"{RVS}W{OFF}";:GO
    TO1010                          :rem 55
990 IFS(X,Y)=-2THENPRINT"*";:GOTO1010
                                    :rem 232
1000 IFS(X,Y)=2THENPRINT"{RVS}*{OFF}";
                                    :rem 73
1010 NEXTX:PRINT"{K}{2 UP}":NEXTY
                                    :rem 249
1020 PRINT"{HOME} ROW":PRINT"{2 SPACES}
     {D}{8 I}{F}{2 UP}"             :rem 67
1030 GOTO170                        :rem 149
1040 GOSUB1060:FORI=1TO40:PRINT"Z";:FORJ=
     1TO50:NEXT:NEXT                :rem 222
1050 PRINT"YOU WIN":END             :rem 147
1060 PRINTB$                        :rem 186
1070 FORXX=1TO8:PRINTA$:NEXTXX:PRINTB$:RE
     TURN                           :rem 68
```

Astro-PANIC!

(Article on page 68.)

```
49152 :076,011,193,120,169,127,184
49158 :141,013,220,169,001,141,179
49164 :026,208,169,233,141,018,039
49170 :208,169,027,141,017,208,020
49176 :169,036,141,020,003,169,050
49182 :192,141,021,003,088,096,059
49188 :173,018,208,201,233,208,053
49194 :031,169,000,141,018,208,097
49200 :169,022,141,024,208,169,013
49206 :200,141,022,208,169,012,038
49212 :141,033,208,141,032,208,055
49218 :169,001,141,025,208,076,174
49224 :005,193,169,233,141,018,063
49230 :208,169,030,141,024,208,090
49236 :169,216,141,022,208,169,241
49242 :000,141,032,208,141,033,133
49248 :208,169,001,141,025,208,080
49254 :230,162,032,159,255,173,089
49260 :141,002,013,137,198,240,071
49266 :003,076,005,193,173,089,141
49272 :198,141,000,208,173,016,088
49278 :208,041,254,013,090,198,162
49284 :141,016,208,173,000,220,122
49290 :041,004,208,029,173,090,171
49296 :198,208,007,173,089,198,249
49302 :201,025,144,017,056,173,254
49308 :089,198,233,002,141,089,140
49314 :198,173,090,198,233,000,030
49320 :141,090,198,173,000,220,222
49326 :041,008,208,029,173,090,211
49332 :198,240,007,173,089,198,061
49338 :201,064,176,017,024,173,073
49344 :089,198,105,002,141,089,048
49350 :198,173,090,198,105,000,194
49356 :141,090,198,173,000,220,002
49362 :041,016,208,047,173,088,015
49368 :198,208,042,056,173,089,214
49374 :198,233,024,133,180,173,139
49380 :090,198,233,000,074,102,157
49386 :180,070,180,070,180,238,128
49392 :088,198,024,165,180,105,232
49398 :033,133,251,133,253,169,194
49404 :007,105,000,133,252,105,086
49410 :212,133,254,104,168,104,209
49416 :170,104,064,032,003,192,061
49422 :169,004,133,252,160,000,220
49428 :185,226,196,153,000,056,068
49434 :200,192,008,208,245,160,015
49440 :000,152,153,000,057,200,082
49446 :192,008,208,248,160,000,086
49452 :185,234,196,153,000,058,102
49458 :200,208,247,169,232,141,223
49464 :248,007,160,007,169,233,112
49470 :153,248,007,136,208,250,040
49476 :169,255,141,028,208,169,014
49482 :000,141,029,208,141,023,104
49488 :208,141,016,208,169,003,057
49494 :141,037,208,169,008,141,022
49500 :038,208,169,212,141,001,093
49506 :208,160,000,185,236,197,060
49512 :153,040,208,200,192,007,136
49518 :208,245,169,006,141,039,150
49524 :208,169,147,032,210,255,113
49530 :160,039,169,160,153,152,187
49536 :007,169,005,153,152,219,065
49542 :136,016,243,160,005,162,088
49548 :024,024,032,240,255,160,107
49554 :000,185,244,197,240,006,250
49560 :032,210,255,200,208,245,022
49566 :160,000,162,023,024,032,047
49572 :240,255,160,000,185,025,005
49578 :198,240,006,032,210,255,087
49584 :200,208,245,169,004,141,119
49590 :035,208,169,014,141,036,017
49596 :208,160,024,169,000,153,134
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49602 :000,212,136,016,250,169,209
49608 :255,141,015,212,169,128,096
49614 :141,018,212,169,143,141,006
49620 :024,212,169,015,141,139,144
49626 :198,169,003,141,136,198,039
49632 :169,000,141,088,198,141,193
49638 :137,198,170,142,090,198,141
49644 :169,184,141,089,198,138,131
49650 :010,168,010,010,010,010,204
49656 :024,105,031,153,091,198,082
49662 :169,000,153,092,198,153,251
49668 :003,208,169,060,157,105,194
49674 :198,032,186,195,232,224,053
49680 :007,208,222,169,255,141,250
49686 :021,208,173,030,208,173,067
49692 :031,208,173,030,208,041,207
49698 :001,240,003,076,230,195,011
49704 :173,141,002,208,251,032,079
49710 :228,255,201,136,208,009,059
49716 :169,032,160,000,145,251,041
49722 :076,188,196,173,088,198,209
49728 :208,003,076,027,195,160,221
49734 :000,169,032,145,251,056,211
49740 :165,251,233,040,133,251,125
49746 :133,253,165,252,233,000,094
49752 :133,252,024,105,212,133,179
49758 :254,173,027,212,009,008,009
49764 :145,253,169,000,145,251,039
49770 :173,031,208,041,254,240,029
49776 :103,133,167,141,138,198,224
49782 :162,000,070,167,070,167,242
49788 :144,071,169,032,141,005,174
49794 :212,169,246,141,006,212,092
49800 :169,129,141,004,212,169,192
49806 :234,157,249,007,160,010,191
49812 :173,027,212,157,040,208,197
49818 :140,001,212,165,162,197,007
49824 :162,240,252,136,208,238,116
49830 :189,236,197,157,040,208,169
49836 :169,233,157,249,007,169,132
49842 :128,141,004,212,138,072,105
49848 :189,105,198,073,255,074,054
49854 :074,074,032,201,196,104,103
49860 :170,232,224,007,208,176,189
49866 :173,138,198,073,255,045,060
49872 :021,208,141,021,208,076,115
49878 :226,194,238,088,198,173,051
49884 :088,198,201,021,208,057,225
49890 :160,000,140,088,198,169,213
49896 :032,145,251,173,031,208,048
49902 :173,030,208,173,021,208,027
49908 :041,254,208,035,173,139,070
49914 :198,240,003,206,139,198,210
49920 :160,038,162,023,024,032,183
49926 :240,255,173,139,198,073,060
49932 :015,170,169,000,032,205,091
49938 :189,169,100,032,201,196,137
49944 :076,224,193,174,139,198,004
49950 :160,000,200,208,253,202,029
49956 :208,250,138,010,168,185,227
49962 :091,198,153,002,208,189,115
49968 :105,198,153,003,208,185,132
49974 :092,198,133,168,056,138,071
49980 :168,200,200,169,000,042,071
49986 :136,208,252,133,167,073,011
49992 :255,045,016,208,164,168,160
49998 :240,002,005,167,141,016,137
50004 :208,232,224,007,208,204,143
50010 :162,000,138,010,168,189,245
50016 :105,198,024,125,112,198,090
50022 :201,210,176,004,201,050,176
50028 :176,006,032,186,195,076,011
50034 :178,195,157,105,198,024,203
50040 :185,091,198,121,120,198,009
50046 :133,167,185,092,198,121,254
50052 :121,198,133,168,208,014,206
50058 :165,167,201,031,240,002,176
50064 :176,006,032,186,195,076,047
50070 :178,195,165,168,240,012,084
50076 :165,167,201,064,144,006,135
50082 :032,186,195,076,178,195,000
50088 :165,167,153,091,198,165,083
50094 :168,153,092,198,232,224,217
50100 :007,208,165,076,030,194,092
50106 :134,169,132,170,173,027,223
50112 :212,041,005,170,189,070,111
50118 :198,166,169,157,112,198,174
50124 :173,027,212,041,005,010,160
50130 :168,185,076,198,166,170,149
50136 :157,120,198,185,077,198,127
50142 :157,121,198,164,170,166,174
50148 :169,096,169,235,141,248,006
50154 :007,169,001,141,137,198,119
50160 :169,009,141,005,212,169,177
50166 :160,141,006,212,169,033,199
50172 :141,004,212,162,100,142,245
50178 :001,212,160,000,173,027,063
50184 :212,141,039,208,141,000,237
50190 :212,136,208,244,202,208,200
50196 :236,169,234,141,248,007,031
50202 :169,001,141,029,208,141,203
50208 :023,208,169,032,141,004,097
50214 :212,169,168,141,006,212,178
50220 :169,129,141,004,212,162,093
50226 :100,142,001,212,160,000,153
50232 :140,000,212,173,027,212,052
50238 :141,039,208,136,208,244,014
50244 :202,208,236,169,232,141,232
50250 :248,007,169,006,141,039,172
50256 :208,169,000,141,029,208,067
50262 :141,023,208,169,128,141,128
50268 :004,212,162,100,160,000,218
50274 :136,208,253,202,208,250,075
50280 :169,000,141,137,198,168,149
50286 :153,002,208,200,192,014,111
50292 :208,248,141,016,208,160,073
50298 :000,169,032,145,251,173,124
50304 :030,208,206,158,007,206,175
50310 :136,198,173,136,198,240,191
50316 :003,076,224,193,160,000,028
50322 :185,203,007,217,222,007,219
50328 :240,005,176,011,076,178,070
50334 :196,200,192,006,208,238,174
50340 :076,178,196,160,006,185,197
50346 :202,007,153,221,007,136,128
50352 :208,247,032,159,255,032,085
50358 :228,255,201,136,208,246,176
50364 :160,006,169,048,153,202,158
50370 :007,136,208,250,076,158,005
50376 :193,170,160,006,056,185,202
50382 :202,007,105,000,201,058,011
50388 :144,002,169,048,153,202,162
50394 :007,136,208,239,202,208,194
50400 :233,096,048,016,032,048,185
50406 :016,032,048,016,000,000,086
50412 :000,000,000,000,000,032,012
50418 :000,000,236,000,000,236,202
50424 :000,003,255,000,015,255,008
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50430 :192,015,087,192,015,255,242
50436 :192,063,087,240,255,255,072
50442 :252,255,087,252,255,255,086
50448 :252,239,087,236,239,255,044
50454 :236,236,220,236,236,220,126
50460 :236,236,220,236,252,000,184
50466 :252,000,000,000,000,000,030
50472 :000,000,000,000,000,000,040
50478 :000,000,000,000,000,000,046
50484 :000,000,003,085,192,013,089
50490 :085,112,063,255,252,234,035
50496 :170,171,226,034,043,058,254
50502 :170,172,013,085,112,003,113
50508 :255,192,000,000,000,000,011
50514 :000,000,000,000,000,000,082
50520 :000,000,000,000,000,000,088
50526 :000,000,000,000,000,000,094
50532 :000,000,000,000,000,000,100
50538 :128,032,008,032,160,032,242
50544 :000,168,160,034,162,160,028
50550 :138,168,130,162,197,042,187
50556 :040,115,008,131,190,224,064
50562 :046,188,162,011,127,064,216
50568 :130,201,088,010,186,074,057
50574 :035,190,232,000,141,032,004
50580 :010,038,010,038,166,160,058
50586 :000,168,168,130,138,040,030
50592 :010,003,128,008,032,000,085
50598 :000,002,032,000,000,000,200
50604 :000,000,000,000,000,016,188
50610 :000,000,118,000,000,118,158
50616 :000,001,255,128,007,255,062
50622 :224,007,171,224,007,255,054
50628 :224,031,171,248,127,255,228
50634 :254,127,171,254,127,255,110
50640 :254,119,171,246,119,255,092
50646 :246,118,110,118,118,110,010
50652 :118,118,110,118,126,000,042
50658 :126,000,000,000,000,000,096
50664 :000,000,000,013,006,004,255
50670 :001,007,008,012,013,014,037
50676 :008,031,211,067,079,082,210
50682 :069,058,158,048,048,048,167
50688 :048,048,048,032,032,149,101
50694 :200,073,071,072,032,211,153
50700 :067,079,082,069,058,028,139
50706 :048,048,048,048,048,048,050
50712 :000,018,149,204,073,086,042
50718 :069,083,058,051,029,029,093
50724 :029,029,029,029,029,028,209
50730 :193,083,084,082,079,045,096
50736 :208,193,206,201,195,033,060
50742 :029,029,029,029,029,029,228
50748 :031,204,069,086,069,076,083
50754 :058,048,032,000,001,255,204
50760 :002,254,003,253,001,000,073
50766 :255,255,002,000,254,255,075
50772 :003,000,253,255,013,013,109
```

Typing Derby

(Article on page 86.)

Program 1:

Typing Derby—VIC Version

```
2 PRINTCHR$(147)"{5 RIGHT}{5 DOWN}{RVS}
  {RED}TYPING DERBY{OFF}":PRINT"{6 DOWN}
  {RIGHT}INSTRUCTIONS? (Y=YES)     :rem 32
4 GETA$:IFA$=""THEN4               :rem 139
```

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

```
6 IFA$="Y"THENGOSUB401:PRINT"{CLR}"
                                   :rem 230
8 PRINT"{HOME}{15 DOWN}{RIGHT}ENTER LEVEL
  :(1TO13)":INPUTL1:IFL1<1ORL1>13THEN4
                                   :rem 14
10 DIMC(3):C(0)=38488:C(1)=38554:C(2)=386
   20:H=7768:H1=7790:J=8010:R=32 :rem 235
11 L=L1:S=(220*(L1-1))+(10*-(L1>1)):GOTO2
   0                               :rem 179
16 PRINT"{CLR}{3 DOWN}{3 RIGHT}CONT'(Y/N)
   ?"                              :rem 22
17 GETX$:IFX$=""THEN17             :rem 33
18 IFX$="N"THENEND                 :rem 73
20 IFS=2880THENPRINT"{4 RIGHT}THE END":EN
   D                               :rem 144
21 M=0:N=0:N1=0:IFS>220*LTHENL=L+1:L1=L1+
   1:R=32                          :rem 247
22 PRINTCHR$(147):POKE36879,219:PRINT"
   {BLK}SCORE:{RVS}"S"{OFF} LEVEL{RVS}"L1
   "{OFF}"                         :rem 138
30 FORI=0TO3:PRINT"{DOWN}{22 R}":NEXT:P
   RINT"{3 UP}{2 LEFT}{RED}{*}{DOWN}
   {LEFT}{M}"                      :rem 255
40 PRINT"{10 DOWN}{5 RIGHT}{RVS}TYPING DE
   RBY{OFF}{BLK}";                 :rem 48
50 FORI=1TOL:READD$:NEXT:RESTORE:PRINT"
   {HOME}{15 DOWN}{BLU}"D$         :rem 43
52 IFL=6THENPOKE8015,44:POKE8067,44
                                   :rem 71
53 IFL=7THENPOKE8023,44            :rem 118
54 IFL=8THENFORI=0TO6STEP2:POKE8010+I,58:
   NEXT                            :rem 132
55 IFL=8THENPOKE8031,44:POKE8070,58:POKE8
   072,58                          :rem 28
56 IFL=9THENPOKE8046,58            :rem 133
60 FORI=0TO2:FORT=0TO21:POKEC(I)+T,2:NEXT
   T:NEXTI:POKEH,94                :rem 188
70 FORI=0TO2:FORT=0TO21:POKEC(I)+22+T,0:N
   EXTT:NEXTI:POKEH1,94            :rem 123
80 IFN=0ANDM=0ORS=(220*L)+10THENGOSUB300
                                   :rem 153
90 IFM=21ORM=87THENM1=M:M=M+44     :rem 90
100 IFPEEK(H1+M+1)<>32THEN15       :rem 87
110 IFTI>T+RTHENPOKEH1+M1,32:POKEH1+M,32:
    M=M+1:POKEH1+M,94:T=TI         :rem 145
120 GETA$:IFA$=""THEN90            :rem 31
130 IFASC(A$)=PEEK(J+N1)THEN150    :rem 28
140 IFASC(A$)<>PEEK(J+N1)+64THEN90
                                   :rem 194
150 POKE38730+N1,2:N1=N1+1:IFN=21ORN=87TH
    ENN2=N:N=N+45                  :rem 214
160 POKEH+N,32:POKEH+N2,32:N=N+1:IFPEEK(H
    +N)<>32THENS=S+10:R=R-1:GOTO16:rem 68
170 POKEH+N,94:GOTO90              :rem 253
200 DATAFRF FTF FGF FBF FVF FRF FTF FGF F
    BF FVF FRF FTF FGF FBF FVF FR  :rem 7
210 DATADED DCD FRF FTF FGF FBF FVF DED D
    CD FRF FTF FGF FBF FVF DED DC:rem 179
220 DATASWS SXS DED DCD FRF FTF FGF FBF F
    VF SWS SXS DED DCD FRF FTF FG :rem 96
230 DATAAQA AZA SWS SXS DED DCD FRF FTF F
    GF AQA AZA SWS SXS DED DCD FR :rem 92
```

```
240 DATAJUJ JYJ JHJ JNJ JMJ AQA AZA SWS S
    XS DED DCD JUJ JYJ JHJ JNJ JM:rem 146
250 DATAKIK KIK JUJ JYJ JHJ JNJ JMJ AQA A
    ZA SWS SXS DED DCD KIK KIK FR:rem 124
260 DATALOL L.L KIK KIK JUJ JYJ JHJ JNJ J
    MJ AQA AZA SWS SXS FTF LOL L.:rem 125
270 DATA;P; ;/; LOL L.L KIK KIK JUJ JYJ J
    HJ JNJ JMJ AQA AZA SWS SXS ;P :rem 51
280 DATAA11 S22 D33 F44 F55 J66 J77 K88 L
    99 ;00 Z11 X22 C33 V44 V55 N6:rem 187
281 DATAIF IF IF{2 SPACES}IT IT IT
    {2 SPACES}IS IS IS TIME TIME TIME IF
    {SPACE}IT IS TIME IF I          :rem 105
282 DATAWE WE WE{2 SPACES}CAN CAN CAN
    {2 SPACES}PLAY PLAY PLAY WE WE WE CAN
     CAN CAN PLA                    :rem 201
287 DATATHAT LITTLE BROWN FOX QUICKLY RUN
    S AND JUMPS OVER THE LAZY DOG :rem 50
290 DATATHIS RACE WILL END THE GAME; IF Y
    OUR TYPING DOES NOT FAIL. BYE :rem 76
300 V=36878:S2=36875:POKEV,15:POKES2,173:
    FORX=1TO150:NEXT:POKEV,0        :rem 249
330 POKEV,15:POKES2,194:FORX=1TO150:NEXT:
    POKEV,0                         :rem 25
340 POKEV,15:POKES2,206:FORX=1TO150:NEXT:
    POKEV,0                         :rem 20
350 FORI=0TO2:POKEV,15:POKES2,214:FORX=1T
    O150:NEXT:POKEV,0:NEXT          :rem 57
360 FORI=0TO2:POKEV,15:POKES2,206:FORX=1T
    O150:NEXT:POKEV,0:NEXT          :rem 59
370 POKEV,15:POKES2,194:FORX=1TO150:NEXT:
    POKEV,0                         :rem 29
380 POKEV,15:POKES2,206:FORX=1TO150:NEXT:
    POKEV,0                         :rem 24
385 POKEV,15:POKES2,194:FORX=1TO150:NEXT:
    POKEV,0                         :rem 35
390 POKEV,15:POKES2,173:FORX=1TO1800:NEXT
    :POKEV,0:RETURN                 :rem 105
401 PRINTCHR$(14)CHR$(147)"{5 RIGHT}{RVS}
    {RED}TYPING DERBY{OFF}{BLU}"  :rem 204
402 PRINT"{2 RIGHT}BASIC TOUCH TYPING
    {4 SPACES}TUTOR":PRINT"{RVS}{DOWN}INS
    TRUCTIONS{OFF}:"                :rem 174
403 PRINT"{RVS}{DOWN}1{OFF}.LEARN FINGERS
    ' RANGE ON THE KEYBOARD."       :rem 13
404 PRINT"{RVS}2{OFF}.PLACE FINGERS ON TH
    E'HOME KEYS'.WRISTS LE-VEL,FINGERS SL
    IGHTLY";                        :rem 181
405 PRINT"{2 SPACES}ARCHED,PALMS OFF VIC.
    "                               :rem 37
406 PRINT"{RVS}3{OFF}.TYPE THE EXERCISES
    {2 SPACES}WITHOUT LOOKING AT THE KEYB
    OARD."                          :rem 250
407 PRINT"{RVS}4{OFF}.AT FIRST,ACCURACY I
    S BETTER THAN SPEED."           :rem 178
408 PRINT"{RVS}5{OFF}.BEAT THE BLACK HORS
    E 23 TIMES AND MOVE ON TO THE NEXT LE
    VEL."                           :rem 198
409 PRINT"{DOWN}PRESS A KEY TO GO ON "
                                    :rem 140
410 GETA$:IFA$=""THEN410            :rem 77
411 PRINTCHR$(147)CHR$(142)"{RVS}{RED}
    {5 RIGHT}{DOWN}TYPING DERBY{BLK}{OFF}
    {BLU}"                          :rem 160
412 POKE36879,232                   :rem 154
414 PRINT"{DOWN}{3 RIGHT}{WHT}{RVS}Q
    {13 RIGHT}Q":PRINT"{RVS}{2 RIGHT}Q3Q
    {11 RIGHT}Q8Q"                  :rem 73
415 PRINT"{RVS}{2 RIGHT}2E4{11 RIGHT}6I9"
                                    :rem 89
416 PRINT"{RIGHT}{RVS}QW{RED}D{WHT}5
    {11 RIGHT}7{RED}K{WHT}OQ":PRINT"
    {RIGHT}{RVS}1{RED}S{WHT}CR{11 RIGHT}Y
    ,{RED}L{WHT}0                   :rem 18
418 PRINT"{RIGHT}{RVS}QX TQ{9 RIGHT}QU .P
    ":PRINT"{RIGHT}{RVS}{RED}A{WHT}
    {2 SPACES}{RED}F{WHT} {9 RIGHT}{BLK}S
    {WHT}H{2 SPACES}{RED}:{WHT}" :rem 167
420 PRINT"{RIGHT}{RVS}Z{2 SPACES}G{WHT}
    {9 RIGHT}{BLK}P{RED}J{WHT}{2 SPACES}/
    ":PRINT"{RIGHT}{RVS}{3 SPACES}V
    {9 RIGHT}{BLK}C{WHT}M{3 SPACES}"
                                    :rem 117
422 PRINT"{RIGHT}{RVS}{3 SPACES}B
    {9 RIGHT}{BLK}E{WHT}N{3 SPACES}":PRIN
    T"{RIGHT}{RVS}{4 SPACES}{OFF}£
    {9 RIGHT}[*]{RVS}{4 SPACES}"
                                    :rem 114
424 PRINT"{RIGHT}{RVS}[H]{3 SPACES}
    {11 RIGHT}{3 SPACES}[N]"        :rem 55
426 PRINT"{RIGHT}{DOWN}{RVS}LEFT
    {10 RIGHT}RIGHT":PRINT"{RIGHT}FINGER
    {SPACE}RANGE":PRINT"{RIGHT}{RVS}{BLK}
    SPACE BAR"                      :rem 211
428 PRINT"{RIGHT}{RVS}{RED}HOME KEYS{BLU}
    {OFF}":PRINT"{DOWN}PRESS ANY KEY TO G
    O ON";                          :rem 91
430 GETA$:IFA$=""THEN430            :rem 81
432 RETURN                          :rem 121
```

Program 2: Typing Derby—64 Version

```
0 FORL=54272TO54296:POKEL,0:NEXTL:POKE532
  81,15:POKE53280,15                :rem 34
1 POKE54296,0:PRINT"{CLR}{8 DOWN}
  {14 RIGHT}{RVS}{RED}TYPING DERBY{OFF}
  {BLK}"                            :rem 35
2 PRINT"{5 DOWN}{9 RIGHT} INSTRUCTIONS (Y
  =YES)"                           :rem 234
4 GETA$:IFA$=""THEN4               :rem 139
6 IFA$="Y"THENGOSUB400             :rem 71
8 PRINT"{CLR}{10 DOWN}{4 RIGHT} ENTER LEV
  EL (1-13)";:INPUTL1               :rem 69
9 IFL1<1ORL1>13THEN8               :rem 217
10 C(0)=55456:C(1)=55576:C(2)=55696:H=118
   4:H1=1224:J=1624                 :rem 211
11 L=L1:S=(220*(L1-1))+(10*-(L1>1))
                                    :rem 222
14 PRINT"{CLR}{11 DOWN}{6 RIGHT} COMPUTER
    SPEED (5-50)"SPC(58)"(50 IS THE SLOWE
   ST)";                            :rem 177
15 INPUTR1:R=R1                     :rem 197
16 IFR<5ORR>50THEN14                :rem 227
17 GOTO21                            :rem 4
18 POKE198,0:PRINT"{CLR}{10 DOWN}
   {4 RIGHT} DO YOU WISH TO CONTINUE? (Y/
   N)";                             :rem 198
19 GETX$:IFX$=""ANDX$<>"N"ANDX$<>"Y"THEN1
   9                                :rem 230
20 IFX$="N"THENEND                  :rem 66
21 M=0:N=0:N1=0:IFS>220*LTHENL=L+1:L1=L1+
   1:R=R1:IFL>13THENPRINT"{CLR} THE END !
   "                                :rem 56
22 PRINTCHR$(147):POKE53280,3:POKE53281,1
   :PRINT"{UP}{BLK}SCORE:{RVS}"S:IFL1>9TH
   EN24                             :rem 11
23 PRINTTAB(30)"{UP}{OFF} LEVEL{2 RVS}"L1
   "{OFF}":GOTO30                  :rem 169
24 PRINTTAB(30)"{2 UP} LEVEL{RVS}"L1"
   {OFF}"                           :rem 193
```

```
30 FORI=1144TO1183:POKEI,114:POKEI+54272,
   0:NEXTI                              :rem 125
31 FORI=1264TO1303:POKEI,91:POKEI+54272,0
   :NEXTI                               :rem 79
32 FORI=1384TO1423:POKEI,91:POKEI+54272,0
   :NEXTI                               :rem 86
33 FORI=1504TO1543:POKEI,113:POKEI+54272,
   0:NEXTI                              :rem 127
34 POKE1502,103:POKE55774,0:POKE1462,95:P
   OKE55734,2                           :rem 142
35 FORI=1TO3*L-2:READD$:NEXTI:RESTORE:PRI
   NT"{HOME}{15 DOWN}{BLU}"D$           :rem 51
50 FORI=1TO3*L-1:READD$:NEXTI:RESTORE:PRI
   NT"{HOME}{16 DOWN}{BLU}"D$           :rem 64
51 FORI=1TO3*L:READD$:NEXTI:RESTORE:PRINT
   "{HOME}{17 DOWN}{BLU}"D$             :rem 244
53 IFL=7THENPOKE1646,44                 :rem 122
54 IFL=8THENFORI=0TO6STEP2:POKE1624+I,58:
   NEXTI                                :rem 240
55 IFL=8THEN:POKE1663,44:POKE1730,58:POKE
   1732,58                              :rem 82
56 IFL=9THENPOKE1689,58                 :rem 139
60 FORI=0TO2:FORT=0TO39:POKEC(I)+T,2:NEXT
   T:NEXTI:POKEH,94                     :rem 197
70 FORI=0TO2:FORT=0TO39:POKEC(I)+40+T,0:N
   EXTT:NEXTI:POKEH1,94                 :rem 132
80 IFN=0ANDM=0ORS=(300*L)+10THENGOSUB300
                                        :rem 152
90 IFM=39ORM=159THENM1=M:M=M+80          :rem 147
100 IFPEEK(H1+M+1)<>32THEN18            :rem 90
110 IFTI>T+RTHENPOKEH1+M1,32:POKEH1+M,32:
    M=M+1:POKEH1+M,94:T=TI              :rem 145
120 GETA$:IFA$=""THEN90                 :rem 31
130 IFASC(A$)=PEEK(J+N1)THEN150         :rem 28
140 IFASC(A$)<>PEEK(J+N1)+64THEN90
                                        :rem 194
150 POKE55896+N1,2:N1=N1+1:IFN=39ORN=159T
    HENN2=N:N=N+81                      :rem 27
160 POKEH+N,32:POKEH+N2,32:N=N+1:IFPEEK(H
    +N)<>32THENS=S+10:R=R-1:GOTO18:rem 70
170 POKEH+N,94:GOTO90                   :rem 253
200 DATAFRF FTF FGF FBF FVF FRF FTF FGF F
    BF FVF                              :rem 46
201 DATAFRF FTF FGF FBF FVF FRF FTF FGF F
    BF FVF                              :rem 47
202 DATAFRF FTF FGF FBF FVF FRF FTF FGF F
    RTB                                 :rem 174
203 DATADED DCD FRF FTF FGF FBF FVF DED D
    CD FRF                              :rem 254
204 DATAFTF FGF FBF FVF DED DCD FRF FTF F
    GF FBF                              :rem 10
205 DATAFVF DED DCD FRF FTF FGF FBF FVF F
    DEV                                 :rem 145
206 DATASWS SXS DED DCD FRF FTF FGF FBF F
    VF SWS                              :rem 131
207 DATASXS DED DCD FRF FTF FGF FBF FVF S
    WS SXS                              :rem 133
208 DATADED DCD FRF FTF FGF FBF FVF SWS S
    CDX                                 :rem 188
209 DATAAQA AZA SWS SXS DED DCD FRF FTF F
    GF AQA                              :rem 91
210 DATAAZA SWS SXS DED DCD FRF FTF FGF A
    QA AZA                              :rem 92
211 DATASWS SXS DED DCD FRF FTF FGF AQA A
    ZQW                                 :rem 232
212 DATAJUJ JYJ JHJ JNJ JMJ AQA AZA SWS S
    XS DED                              :rem 155
213 DATADCD JUJ JYJ JHJ JNJ JMJ AQA AZA S
    WS SXS                              :rem 154
214 DATADED DCD JUJ JYJ JHJ JNJ JMJ AQA J
    UQX                                 :rem 217
215 DATAKIK KIK JUJ JYJ JHJ JNJ JMJ AQA A
    ZA SWS                              :rem 145
216 DATASXS DED DCD KIK KIK FRF JUJ JYJ J
    NJ JMJ                              :rem 126
217 DATAAQA AZA SWS SXS DED DCD KIK KIK K
    IZD                                 :rem 230
218 DATALOL L.L KIK KIK JUJ JYJ JHJ JNJ J
    MJ AQA                              :rem 104
219 DATAAZA SWS SXS FTF LOL L.L KIK KIK J
    UJ JYJ                              :rem 174
220 DATAJHJ JNJ JMJ AQA AZA SWS SXS FTF L
    ZJM                                 :rem 20
221 DATA;P; ;/; LOL L.L KIK KIK JUJ JYJ J
    HJ JNJ                              :rem 25
222 DATAJMJ AQA AZA SWS SXS ;P; ;/; LOL L
    .L KIK                              :rem 50
223 DATAKIK JUJ JYJ JHJ JNJ JMJ AQA AZA S
    K;Q                                 :rem 222
224 DATAA11 S22 D33 F44 F55 J66 J77 K88 L
    99 ;00                              :rem 150
225 DATAZ11 X22 C33 V44 V55 N66 A11 S22 D
    33 F44                              :rem 190
226 DATAF55 J66 J77 K88 L99 ;00 Z11 X22 C
    3F5                                 :rem 79
227 DATAIF IF{2 SPACES}IT IT IT{2 SPACES}
    IS IS IS TIME TIME IF I             :rem 180
228 DATAF IF IT IS TIME IF IT IS IS IS IT
     IT IT IS                           :rem 102
229 DATAIF IF IS IS TIME TIME TIME IT IT
    {SPACE}IFS                          :rem 182
230 DATAWE WE WE{2 SPACES}CAN CAN CAN
    {2 SPACES}PLAY PLAY PLAY WE         :rem 55
231 DATAWE WE WE CAN CAN CAN PLAY CAN PLA
    Y WE WE                             :rem 112
232 DATACAN CAN WE WE PLAY PLAY WE CAN
    {2 SPACES}CANN                      :rem 135
233 DATATHE LITTLE BROWN FOX QUICKLY RUNS
     AND JU                             :rem 178
234 DATAMPS OVER THE LAZY DOG.DOG IS LAZY
    .FOX IS                             :rem 117
235 DATA JUMPING.DOG IS SLEEPY AND VERY A
    NGRY                                :rem 222
236 DATATHIS RACE WILL END THE GAMES;IF Y
    OUR TYP                             :rem 123
237 DATAING DOES NOT FAIL.BYE.YOUR TYPING
     SHOULD                             :rem 1
238 DATA NOT FAIL. YOUR PRACTICE WAS RIGO
    ROUS                                :rem 241
300 V=54296:V1=54276:AD=54277:SR=54278:FH
    =54273:FL=54272                     :rem 120
301 POKEV,15:POKEFH,70:POKEFL,75 :rem 200
302 POKEAD,26:POKESR,178:FORT=1TO10:POKEV
    1,17                                :rem 34
303 FORQ=1TO150:NEXT:POKEV1,16:NEXT
                                        :rem 234
304 POKE54296,0:RETURN                  :rem 70
400 PRINT"{CLR}{DOWN}{13 RIGHT}{RVS}{RED}
    TYPING DERBY{OFF}{BLK}"             :rem 35
401 PRINT"{DOWN}{6 RIGHT}{RVS}{RED} BASIC
     TOUCH TYPING TUTOR{OFF}{RED}":rem 95
402 PRINT"{2 DOWN}{2 RIGHT}{RVS}1{OFF}
    {WHT} LEARN FINGERS' RANGE ON THE KEY
    -{8 SPACES}BOARD{RED}"              :rem 201
403 PRINT"{DOWN}{2 RIGHT}{RVS}2{OFF}{WHT}
     TYPE WITHOUT LOOKING AT THE KEYBOARD
    {RED}"                              :rem 250
404 PRINT"{DOWN}{2 RIGHT}{RVS}3{OFF}{WHT}
     AT FIRST, ACCURACY IS BETTER THAN
    {7 SPACES}SPEED{RED}"               :rem 62
405 PRINT"{DOWN}{2 RIGHT}{RVS}4{OFF}{WHT}
     BEAT THE BLACK HORSE 23 TIMES AND
```

```
    {7 SPACES}MOVE ON ";              :rem 54
406 PRINT"TO THE NEXT LEVEL":PRINT"
    {3 DOWN}{6 RIGHT}{RVS}{BLK} PRESS ANY
     KEY TO CONTINUE{OFF}"            :rem 44
407 GETF$:IFF$=""THEN407             :rem 99
650 PRINT"{CLR}":POKE53280,9:POKE53281,15
                                     :rem 205
660 PRINT"{CLR} {WHT}":PRINT"{9 SPACES}
    {RVS} Q {OFF}{16 SPACES}{RVS} Q "
                                     :rem 104
670 PRINT"{6 SPACES}{RVS} Q{M} 3{M} Q
     {OFF}{10 SPACES}{RVS} Q{M} 8{M}
    {SPACE}Q "                       :rem 111
680 PRINT"{6 SPACES}{RVS} 2{M} E{M} 4
     {OFF}{10 SPACES}{RVS} 6{M} I{M}
    {SPACE}9 "                       :rem 36
690 PRINT"{3 SPACES}{RVS} Q{N} W{N}
    {5}D{WHT}{M} 5 {OFF}{10 SPACES}
    {RVS} 7{N} {5}K{WHT}{M} O{M}
    {SPACE}Q "                       :rem 150
700 PRINT"{3 SPACES}{RVS} 1{M} {5}S
    {WHT}{M} C{M} R {OFF}{10 SPACES}
    {RVS} Y{M} ,{M} {5}L{WHT}{M}
    {SPACE}0 "                       :rem 92
710 PRINT"{3 SPACES}{RVS} Q{M} X{M}
    {2 SPACES}{M} T{M} Q {OFF}
    {4 SPACES}{RVS} Q{M} U{M}
    {2 SPACES}{M} .{M} P "           :rem 201
720 PRINT"{3 SPACES}{RVS} {5}A{WHT}
    {M}{7 SPACES}{5}F{WHT}{M}
    {3 SPACES}{OFF}{4 SPACES}{RVS} {BLK}S
    {WHT}{M} H{6 SPACES}{M} {5}:
    {WHT} "                          :rem 132
730 PRINT"{3 SPACES}{RVS} Z{M}
    {7 SPACES}G{M}{3 SPACES}{OFF}
    {4 SPACES}{RVS} {BLK}P{WHT}{M}
    {5}J{WHT}{6 SPACES}{M} / "       :rem 89
740 PRINT"{3 SPACES}{RVS}{10 SPACES}V
    {M}{3 SPACES}{OFF}{4 SPACES}{RVS}
    {BLK}C{WHT}{2 SPACES}M{10 SPACES}"
                                     :rem 68
750 PRINT"{3 SPACES}{RVS}{10 SPACES}B
    {4 SPACES}{OFF}{4 SPACES}{RVS} {BLK}E
    {WHT}{2 SPACES}N{10 SPACES}"     :rem 141
760 PRINT"{3 SPACES}{RVS}{14 SPACES}{OFF}
    £{4 SPACES}{*}{RVS}{14 SPACES}"
                                     :rem 172
770 PRINT"{3 SPACES}{*}{RVS}{12 SPACES}
    {OFF}£{6 SPACES}{*}{RVS}
    {12 SPACES}{OFF}£"               :rem 199
780 PRINT"{4 SPACES}{*}{RVS}{10 SPACES}
    {OFF}£{8 SPACES}{*}{RVS}
    {10 SPACES}{OFF}£"               :rem 200
790 PRINT"{5 SPACES}{RVS}{10 SPACES}{OFF}
    {10 SPACES}{RVS}{10 SPACES}"     :rem 39
800 PRINT"{5 SPACES}{RVS}{10 SPACES}{OFF}
    {10 SPACES}{RVS}{10 SPACES}"     :rem 31
810 PRINT:PRINT"{8 SPACES}{RVS}LEFT{OFF}
    {16 SPACES}{RVS}RIGHT"           :rem 144
820 PRINTTAB(14)"FINGER RANGE":PRINT"
    {DOWN}{15 SPACES}{RVS}{BLK}SPACE BAR
    {OFF}"                           :rem 177
830 PRINT"{15 SPACES}{RVS}{5}HOME KEYS
    {OFF}"                           :rem 13
840 PRINT"{DOWN}{7 RIGHT}{WHT}PRESS ANY K
    EY TO CONTINUE";                 :rem 239
850 GETQ$:IFQ$=""THEN850             :rem 125
860 RETURN                           :rem 126
```

Cassette Cataloger

(Article on page 98.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

```
10 FORI=707TO725:READA:POKEI,A:CK=CK+A:NE
   XT:IFCK<>2384THENPRINT"{WHT}DATA ERROR
   "                                 :rem 38
11 IFCK<>2384THENSTOP                :rem 63
12 BC$=CHR$(14):SYS65517:IFPEEK(781)=40TH
   ENTYPE=64:GOTO14                  :rem 177
13 POKE36879,8:B$="{CLR}":M1=36876:POKE36
   876+2,15:GOTO20                   :rem 250
14 SO=54272:FORT=SOTOSO+24:POKET,0:NEXT
                                     :rem 4
15 POKE53280,0:POKE53281,0:POKESO+24,15:P
   OKESO+5,17:B$="{CLR}{8 RIGHT}":rem 132
16 POKESO+6,250:POKESO,100:POKESO+1,160
                                     :rem 78
20 DIM LOC(50),N$(50),BYTES(50):I=1:J$=CH
   R$(16):CR$=CHR$(13)               :rem 2
25 M$="CASSETTE CATALOG"+CR$         :rem 148
30 LC$=CHR$(15):PRINTB$"{CYN}{RVS}{DOWN}-
   ---TAPE DIRECTORY---{OFF}"        :rem 23
40 INPUT"{WHT}{HOME}{4 DOWN}HARDCOPY (Y/N
   )";H$:IF H$="←" THENEND           :rem 215
50 IFH$="Y"THENINPUT"{RVS}{DOWN}{YEL}PRIN
   TER ON{OFF}";H$:H=1:GOSUB900:OPEN4,4,7
                                     :rem 158
55 S$="ONE":PRINT"{DOWN}{WHT}CASSETTE NAM
   E:";:INPUTCN$:INPUT"{DOWN}SIDE 1 OR 2"
   ;S                                :rem 172
60 INPUT"{DOWN}DATE:";DA$:IFS=2THENS$="TW
   O"                                :rem 51
65 CN$=CN$+"/"+S$                    :rem 82
70 PRINT"{RVS}{DOWN}REWIND TAPE.{OFF}": P
   RINT"{RVS}{DOWN}SET COUNTER.{OFF}": PR
   INT"{RVS}{DOWN}PRESS F7 KEY.{OFF}{YEL}
   "                                 :rem 135
80 GETA$:IFA$<>CHR$(136)THEN80       :rem 216
100 GOSUB900:CLOSE1:IFST=-128THEN700
                                     :rem 198
110 SYS 707:IFST=-128THEN700         :rem 106
120 B1=PEEK(829)+256*PEEK(830):B2=PEEK(83
    1)+256*PEEK(832):BYTES(I)=B2-B1
                                     :rem 13
130 IFI=1THENM$=M$+CN$+CR$+DA$:PRINT"
    {CLR}{DOWN}"M$                   :rem 224
140 IFI=1THENIFH=1THENPRINT#4,BC$;M$;LC$;
    CR$                              :rem 197
200 L$="":GOSUB900:GOSUB900:INPUT"{PUR}
    {RVS}COUNTER{OFF}:";L$:IFL$=""THEN200
                                     :rem 247
210 L=VAL(L$)                        :rem 192
220 IFI=1THENLOC(2)=L:LOC(1)=0:GOTO300
                                     :rem 0
230 LOC(I+1)=L                       :rem 242
300 FORX=0TO15:N$(I)=N$(I)+CHR$(PEEK(833+
    X)):NEXT                         :rem 100
350 PRINT"{RED}{RVS}"LOC(I);TAB(4);"{WHT}
    "N$(I)"{2 RIGHT}{GRN}{RVS}"BYTES(I)"
    {LEFT} BYTES.":GOSUB900          :rem 238
360 IFH=1THENGOSUB920                :rem 40
```

```
370 IFL$="←"THENCLOSE1:GOTO700    :rem 89
400 I=I+1:GOTO100                 :rem 195
700 PRINT"{WHT}I/O STATUS="ST:GOSUB900:CL
    OSE1:LM=I:IFN$(LM)=""THENLM=I-1
                                  :rem 219
800 IFH=1THENPRINT#4:CLOSE4:H=0   :rem 195
810 D$="":INPUT"{WHT}DISPLAY Y/N/H";D$:IF
    D$="N"THENEND                 :rem 161
820 IFD$="H"THEN CLOSE4:OPEN4,4:PRINT#4,B
    C$;M$;LC$:H=1                 :rem 176
830 PRINT"{CLR}{GRN}{RVS}"CN$:FOR I=1TOLM
    :PRINT"{YEL}{RVS}"LOC(I);TAB(4)"{WHT}
    "N$(I)"{6 RIGHT}{GRN}{RVS}"BYTES(I)
                                  :rem 90
840 IF D$="H"THENGOSUB920         :rem 166
845 IFI/10=INT(I/10)THENINPUT"{WHT}MORE Y
    /N";M$:IFM$="N"THEN800        :rem 232
850 IFI/10=INT(I/10)THENINPUT"{WHT}MORE Y
    /N";M$:IFM$="N"THEN810        :rem 229
860 NEXT:GOTO800                  :rem 232
900 IFTYPE=64THEN910              :rem 218
905 POKEM1,232:FORS=1TO50:NEXT:POKEM1,0:R
    ETURN                         :rem 206
910 POKESO+4,17:POKESO+4,16:RETURN
                                  :rem 117
920 PRINT#4,LOC(I);J$+"06";N$(I);J$+"24";
    BYTES(I)J$"29"+"BYTES.":RETURN:rem 29
1000 DATA 169,1,170,160,0,32,186,255,169,
     0,32,189,255,169,1,32,213,255,96
                                  :rem 13
```

Homonym Practice

(Article on page 102.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

Program 1:
Homonym Practice—VIC And 64 Version

```
2 PRINTCHR$(14):CH$="1":PRINT"{CLR}{DOWN}
  HI, I'M VIC,","{DOWN} WHAT'S YOUR NAME
  ?{4 DOWN}"                      :rem 106
3 GETC$:IFC$=""THEN3              :rem 141
4 N$=CHR$(ASC(C$)OR128)           :rem 0
5 PRINTN$;                        :rem 111
6 GETC$:IFC$=""THEN6              :rem 147
7 IFASC(C$)=13THENN$=N$+"{4 SPACES}":GOTO
  10                              :rem 137
8 IFASC(C$)=133THEN2              :rem 139
9 N$=N$+C$:PRINTC$;:GOTO6         :rem 254
10 PRINT"{CLR}{DOWN} HI, ";N$:PRINT"
   {3 DOWN} TODAY WE'LL PRACTICE":PRINT"
   {DOWN} SOME HOMONYMS."         :rem 157
11 GOSUB 51:PRINT "{CLR}{DOWN} WOULD YOU
   {SPACE}LIKE TO","{DOWN} PRACTICE USING
   ","{2 DOWN}{2 SPACES}1) TO{2 SPACES}TW
   O";                            :rem 221
12 PRINT"{2 SPACES}TOO","{3 DOWN} OR",,"
   {3 DOWN}{2 SPACES}2) THERE{3 SPACES}TH
   EIR {DOWN}{11 SPACES}THEY'RE" :rem 145
13 PRINTTAB(12)"{2 DOWN}? ";      :rem 92
14 GET CH$:IF CH$=""THEN14        :rem 129
15 PRINTCH$:GOSUB51:PRINT"{CLR}{DOWN} IF
   {SPACE}YOU WANT TO SEE","{DOWN} EXAMPL
   ES";                           :rem 82
16 PRINT" OF EACH","{DOWN} WORD USED IN A
   ","{DOWN} SENTENCE,"           :rem 166
17 PRINT"{DOWN} JUST PRESS THE","{DOWN} B
   ROWN BUTTON","{DOWN} MARKED {RVS} F3
   {OFF} .":GOSUB51               :rem 131
18 PRINT"{CLR}{DOWN} YOU MAY USE THE","
   {DOWN} BROWN {RVS} F3 {OFF} BUTTON","
   {DOWN} ANYTIME YOU NEED IT."   :rem 142
19 GOSUB51:PRINT"{CLR}{DOWN} YOU MUST TYP
   E ","{DOWN} THE WORD THAT","{DOWN} GOE
   S IN THE *** ."                :rem 169
20 PRINT"{3 DOWN} PRESS {RVS} RETURN
   {OFF}","{DOWN} AFTER EACH ANSWER.":GOS
   UB51                           :rem 25
21 SC=0:G=0:S=INT((RND(1)*10)+2)  :rem 249
22 W=S:IFASC(CH$)=50THENW=S+16    :rem 53
23 RESTORE:FORT=1TOW:READA$,B$:NEXTT
                                  :rem 128
24 READA$,B$:S=S+1:IFS>17THENS=1:GOTO22
                                  :rem 123
25 C=C+1:IFC>2THENC=0:GOTO24      :rem 186
26 IFASC(C$)=134THENGOSUB42       :rem 112
27 PRINT"{CLR}{5 DOWN}";A$        :rem 194
28 PRINT"{HOME}{14 DOWN}{4 SPACES}*** = "
   ;                              :rem 50
29 GET C$:IF C$=""THEN 29         :rem 253
30 IFASC(C$)=55THENC$="'"         :rem 102
31 IFASC(C$)=13THEN36             :rem 187
32 IFASC(C$)=133THEN2             :rem 184
33 IFASC(C$)=134THEN26            :rem 240
34 IFASC(C$)=20THENAN$=LEFT$(AN$,LEN(AN$)
   -1):PRINTC$;:GOTO29            :rem 74
35 PRINTC$;:AN$=AN$+C$:GOTO29     :rem 228
36 IFAN$=B$THENPRINT"{HOME}{DOWN}VERY GOO
   D,";N$:SC=SC+1:FORT=1TO800:NEXTT:AN$="
   ":GOTO39                       :rem 113
37 PRINT"{HOME}{DOWN}SORRY, TRY AGAIN.":A
   N$="":SC=SC-1                  :rem 166
38 PRINT"{HOME}{14 DOWN}{19 SPACES}":GOTO
   28                             :rem 26
39 G=G+1:IFG<10THEN24             :rem 213
40 PRINT"{CLR}{DOWN} ";N$:PRINT"{2 DOWN}
   {SPACE}YOU GOT "SC" RIGHT","{DOWN}
   {2 SPACES}OUT OF TEN."         :rem 149
41 PRINT"{4 DOWN}{3 SPACES}THAT'S
   {2 SPACES}";100-((10-SC)*10);"%":GOSUB
   51:GOTO2                       :rem 88
42 IFASC(CH$)=50THEN47            :rem 8
43 PRINT"{CLR}{DOWN} TWO",,"{DOWN}
   {4 SPACES}I HAVE TWO TOYS."    :rem 231
44 PRINT"{2 DOWN} TOO",,"{DOWN}{4 SPACES}
   HE ATE TOO MUCH."              :rem 46
45 PRINT"{2 DOWN} TOO",,"{DOWN}{4 SPACES}
   I WANT SOME,TOO."              :rem 126
46 PRINT"{2 DOWN} TO",,"{DOWN}{4 SPACES}G
   O TO THE STORE.","{DOWN}{4 SPACES}I WA
   NT TO SEE IT.":GOTO50          :rem 169
47 PRINT"{CLR}{2 DOWN} THERE",,"{DOWN}
   {4 SPACES}THE BOOK IS OVER{10 SPACES}T
   HERE."                         :rem 32
48 PRINT"{2 DOWN} THEIR",,"{DOWN}
   {4 SPACES}THEY LOST THEIR{12 SPACES}HA
   TS."                           :rem 94
49 PRINT"{2 DOWN} THEY'RE",,"{DOWN}
   {4 SPACES}THEY'RE GOING HOME{8 SPACES}
   NOW."                          :rem 60
50 AN$="":GOSUB51:RETURN          :rem 211
```

```
51 PRINT"{HOME}{21 DOWN}{4 SPACES}{RVS} P
   RESS RETURN {OFF}{2 SPACES}"  :rem 192
52 GETT$:IFT$=""THEN52           :rem 23
53 IFASC(T$)=134THENGOSUB42      :rem 129
54 IFASC(T$)=133THEN2            :rem 205
55 RETURN                        :rem 74
56 DATA1,1                       :rem 19
57 DATA"THAT'S WAY *** MUCH!",TOO:rem 208
58 DATA"I HAD *** MUCH TO EAT{2 SPACES}
   {DOWN}LAST NIGHT.",TOO        :rem 148
59 DATA"WE'RE GOING *** FAST!",TOO :rem 5
60 DATA"LET'S GO OVER *** MY{2 SPACES}
   {DOWN} HOUSE.",TO             :rem 43
61 DATA"MARY WANTS *** COME{4 SPACES}
   {DOWN} OVER HERE.",TO         :rem 27
62 DATA"I DON'T KNOW HOW ***{2 SPACES}
   {DOWN} DO THIS ONE.",TO       :rem 81
63 DATA"PETER THINKS THAT IT'S {DOWN} ***
    FAR TO WALK.",TOO            :rem 102
64 DATA"THERE ARE *** TIGERS{2 SPACES}
   {DOWN} IN THE ZOO.",TWO       :rem 185
65 DATA"WHAT IS *** TIMES{5 SPACES}{DOWN}
    SIXTY-FOUR?.",TWO            :rem 199
66 DATA"WHERE IS TRUDY GOING{3 SPACES}
   {DOWN}*** LOOK FOR IT?",TO    :rem 67
67 DATA"LATONIA WOULD LIKE{4 SPACES}
   {DOWN} SOME ICE CREAM, ***.",TOO
                                 :rem 119
68 DATA"LITTLE JIM CAN COME{3 SPACES}
   {DOWN} ALONG, ***.",TOO       :rem 232
69 DATA"I HOPE THERE WON'T{4 SPACES}
   {DOWN} BE *** MANY.",TOO      :rem 64
70 DATA"HOW MUCH WOULD ***{4 SPACES}
   {DOWN} HAMBURGERS COST?",TWO  :rem 8
71 DATA"THIS WORK IS *** HARD {DOWN} FOR
   {SPACE}ALISA.",TOO            :rem 40
72 DATA"CAN MARK GO TO THE{4 SPACES}
   {DOWN} PARTY, *** ?",TOO      :rem 134
73 DATA"ARE THOSE YOUR BOOKS{2 SPACES}
   {DOWN} OVER ***?",THERE       :rem 30
74 DATA"CAN WE PLAY AT ***{4 SPACES}
   {DOWN} HOUSE?",THEIR          :rem 124
75 DATA"I'M SURE THAT *** NOT {DOWN} HOME
    YET.",THEY'RE                :rem 100
76 DATA"THE CHILDREN PUT ***{2 SPACES}
   {DOWN} BOOKS AWAY.",THEIR     :rem 131
77 DATA"TOM AND SUE SAID ***{2 SPACES}
   {DOWN} COMING LATER.",THEY'RE :rem 179
78 DATA"THE BOYS LOST ***{5 SPACES}{DOWN}
    BALL.",THEIR                 :rem 45
79 DATA"IS KIM SURE THAT ***{2 SPACES}
   {DOWN} COMING TONIGHT?",THEY'RE
                                 :rem 135
80 DATA"IS *** A DRAGON IN{4 SPACES}
   {DOWN} THE CLOSET?",THERE     :rem 146
81 DATA"CAN YOU SEE *** BIG{3 SPACES}
   {DOWN} BLUE EYES?",THEIR      :rem 153
82 DATA"PAUL AND TOM ARE ON{3 SPACES}
   {DOWN} *** WAY.",THEIR        :rem 136
83 DATA"I THINK THAT *** TOO{2 SPACES}
   {DOWN} HIGH TO REACH.",THEY'RE :rem 58
84 DATA"THE BOYS LEFT ***{5 SPACES}{DOWN}
    JUNK ALL OVER!",THEIR        :rem 56
85 DATA"LOOK OVER ***.",THERE    :rem 12
86 DATA"I THINK *** GONE.",THEY'RE:rem 12
87 DATA"GIVE ME *** ADDRESS.",THEIR
                                 :rem 100
88 DATA"CAN MOLLY TAKE ***{4 SPACES}
   {DOWN} PLACE?",THEIR          :rem 45
89 DATA1,1                       :rem 25
```

Program 2: Screen Formatter

```
100 PRINT "{CLR}{4 SPACES}{RVS}22-COLUMN
    {SPACE}PRINT FORMATTER FOR C64":PRINT
                                 :rem 2
110 PRINT "READING DATA"         :rem 119
120 FORI=828TO881:READA:CK=CK+A:POKEI,A:N
    EXT:POKE179,883AND255        :rem 92
130 IF CK<>6032 THEN PRINT "ERROR IN DATA
    :CHECK TYPING.":END          :rem 227
140 PRINT"{DOWN}BEFORE...":SYS 828:PRINT"
    AFTER..."                    :rem 150
150 PRINT "{DOWN}PRESS RUN/STOP-RESTORE";
    :PRINT"TO REGAIN 40 COLUMNS" :rem 228
160 PRINT "{DOWN}ENTER {RVS}SYS 828{OFF}
    {SPACE}TO":PRINT"REACTIVATE, IF":PRIN
    T"NECESSARY."                :rem 115
170 PRINT "{DOWN}DO NOT EDIT ANY":PRINT"L
    INES WHILE IN 22 COL-UMN MODE."
                                 :rem 84
1000 DATA169,71,141,38,3,169,3,141
                                 :rem 180
1010 DATA39,3,96,72,152,72,138,72:rem 141
1020 DATA56,32,240,255,192,9,176,3
                                 :rem 185
1030 DATA76,100,3,192,31,144,15,169
                                 :rem 226
1040 DATA13,32,202,241,56,32,240,255
                                  :rem 9
1050 DATA160,9,24,32,240,255,104,170
                                 :rem 14
1060 DATA104,168,104,76,202,241  :rem 30
```

React

(Article on page 72.)

Program 1: React—VIC Version (Character Loader)

```
10 PRINT"{CLR}{WHT}":POKE36879,107 :rem 8
20 PRINT"DO YOU WANT TO CENTER THE SCREEN
   (Y/N)"                        :rem 41
30 GETA$:IFA$<>"Y"ANDA$<>"N"THEN30
                                 :rem 195
40 IFA$="Y"THENGOSUB10000        :rem 210
50 PRINT"{CLR}":POKE36879,8      :rem 167
60 PRINT"LOADING CHARACTERS{4 SPACES}PLEA
   SE WAIT"                      :rem 4
70 POKE52,28:POKE56,28:CLR       :rem 24
80 FORI=7168TO7679:POKEI,PEEK(I+25600):NE
   XT                            :rem 105
120 FORI=7168TO7175:READA:POKEI,A:NEXT:DA
    TA24,90,36,24,24,24,36,66    :rem 67
130 FORI=7384TO7551:READA:POKEI,A:NEXT
                                 :rem 123
140 DATA0,0,24,24,60,90,60,66    :rem 176
141 DATA60,66,165,129,165,154,66,60
                                 :rem 246
142 DATA255,129,165,129,189,165,189,255
                                 :rem 209
143 DATA0,126,126,126,126,126,126,0
                                 :rem 220
144 DATA170,255,85,255,170,255,85,255:DAT
    A0,0,0,0,0,0,0,0             :rem 105
145 DATA0,6,8,60,126,126,126,60  :rem 29
146 DATA24,60,126,255,255,255,60,60
                                 :rem 238
147 DATA56,60,254,255,255,254,60,56
                                 :rem 250
```

```
148 DATA60,60,255,255,255,126,60,24
                                    :rem 240
149 DATA28,60,127,255,255,127,60,28
                                    :rem 248
150 DATA0,0,56,40,8,20,34,127       :rem 174
151 DATA28,34,42,34,28,20,119,0     :rem 26
152 DATA219,195,36,153,153,36,195,219
                                    :rem 96
153 DATA75,75,75,75,180,180,180,180
                                    :rem 251
154 DATA126,102,66,126,24,36,195,66
                                    :rem 243
155 DATA60,66,189,255,255,189,66,60:rem 9
156 DATA0,0,56,68,146,68,56,0       :rem 199
157 DATA0,60,60,60,60,60,255,0      :rem 229
158 DATA129,195,231,255,255,231,195,129
                                    :rem 198
159 DATA0,102,102,0,66,102,60,24    :rem 62
160 FORI=7632TO7679:READA:POKEI,A:NEXT
                                    :rem 133
161 DATA171,171,173,173,181,181,213,213
                                    :rem 174
162 DATA195,195,0,24,24,0,195,195:rem 143
163 DATA255,145,145,159,249,137,137,255
                                    :rem 200
164 DATA0,0,151,146,242,146,151,0:rem 117
165 DATA165,36,231,24,24,231,36,165
                                    :rem 236
166 DATA195,231,126,60,60,126,231,195
                                    :rem 83
170 POKE198,5:POKE631,78:POKE632,69:POKE6
    33,87:POKE634,13:POKE635,131:END
                                    :rem 22
10000 PRINT"{CLR}CENTER SCREEN WITH
      {4 SPACES}CURSOR KEYS.{2 SPACES}WHE
      N{4 SPACES}FINISHED, HIT <RETURN>"
                                    :rem 65
10001 A=PEEK(197):B=PEEK(653):IFA=15THEN1
      0009                          :rem 42
10002 IFA=31THENA=36865:GOTO10005:rem 134
10003 IFA=23THENA=36864:GOTO10005:rem 135
10004 GOTO10001                     :rem 32
10005 IFB=1THENB=-1                 :rem 65
10006 IFB=0THENB=1                  :rem 20
10007 Q=PEEK(A):IFQ+B<0OR(Q+B>17ANDA=3686
      4)THEN10001                    :rem 3
10008 POKEA,Q+B:GOTO10001          :rem 184
10009 PRINT"{CLR}":RETURN          :rem 120
```

Program 2: React—VIC Version (Main Game)

```
5 POKE36878,15                      :rem 6
10 POKE36879,238:PRINTCHR$(147)CHR$(144)
                                    :rem 10
20 PRINT"RRRRR"                     :rem 205
21 FORI=1TO3:PRINT"R{3 SPACES}R":NEXT
                                    :rem 255
24 PRINT"RRRRR E A C T"             :rem 238
25 PRINT"RR"                        :rem 220
26 PRINT"R R"                       :rem 221
27 PRINT"R{2 SPACES}R"              :rem 222
28 PRINT"R{3 SPACES}R"              :rem 223
30 FORI=8TO248STEP16:FORJ=0TO7:POKE36879,
   I+J                              :rem 2
40 POKE36875,160+J+(I/16):NEXT:NEXT:POKE3
   6875,0:POKE36879,62              :rem 5
50 PRINT:PRINT"PRESS THE FIRE BUTTON TO S
   TART"                            :rem 158
109 CO=36879:A=7901:SM=28:ML=5      :rem 201
110 C=30720:ER=32:MA=0:TR=30:CH=33:WA=31:
    S=36875:V=36878:DD=37154:PA=37137
                                    :rem 213
120 PB=37152:OP=127:TF=255:N1=128:N2=8:N3
    =16:N4=4:NE=1:SC=0:DIMJS(2,2):NM=2:NC
    =1:CL=NC                        :rem 43
130 FORI=0TO2:FORJ=0TO2:READJS(J,I):NEXT:
    NEXT:DATA-23,-22,-21,-1,0,1,21,22,23
                                    :rem 250
135 GOSUB390:IFFR=0THEN135          :rem 75
136 POKES,230:FORI=1TO4:NEXT:POKES,0
                                    :rem 29
160 PRINTCHR$(147):POKECO-10,255:POKECO,8
                                    :rem 194
180 GOSUB430                        :rem 176
190 A=7703:FORI=1TONM               :rem 255
200 W=INT(RND(I)*505)+1:J=INT(RND(I)*6)+2
    :IFPEEK(7680+W)<>32THEN200      :rem 110
205 IFW+7680=ATHEN200               :rem 188
210 POKES,150:POKES+1,230:POKEW+7680,28:P
    OKEW+C+7680,J:POKES,0:POKES+1,0:NEXT
                                    :rem 175
220 FORI=1TONC                      :rem 102
230 W=INT(RND(I)*505)+1:J=INT(RND(I)*6)+2
    :K=INT(RND(I)*64)+1:IFPEEK(7680+W)<>3
    2THEN230                        :rem 224
235 IFK>26ANDK<33ORK=0ORW+7680=ATHEN230
                                    :rem 109
240 POKES,240:POKES+1,200:POKEW+7680,K:PO
    KEW+C+7680,J:POKES,0:POKES+1,0:NEXT
                                    :rem 144
249 TI$="000000"                     :rem 1
250 POKEA,MA:GOSUB400:B=A+JS(X+1,Y+1)
                                    :rem 183
260 IFPEEK(B)=WAORPEEK(B)=TRORPEEK(B)=SMT
    HEN560                          :rem 240
270 IFPEEK(B)=MATHEN290             :rem 117
280 IFPEEK(B)<>ERTHENPOKES,240:SC=SC+50:C
    L=CL-NE:POKES,0:IFCL=.THEN600:rem 141
290 POKES,200:POKES,0:SC=SC+NE:POKEA,TR:A
    =B:GOTO250                      :rem 212
390 P=PEEK(PA):FR=-((PAND32)=0):RETURN
                                    :rem 29
400 POKEDD,OP:S3=-((PEEK(PB)ANDN1)=MA):PO
    KEDD,TF                         :rem 190
410 P=PEEK(PA):S1=-((PANDN2)=MA):S2=((PAN
    DN3)=MA):S0=((PANDN4)=MA)       :rem 122
420 X=S2+S3:Y=S0+S1:RETURN          :rem 125
430 TC=INT(RND(I)*6)+2:FORI=7680TO8185:PO
    KEI+C,TC:NEXT                   :rem 51
440 FORI=7680TO7701:POKEI,WA:POKEI+C,NE:P
    OKEI+485,WA:POKEI+C+485,NE:NEXT:rem 7
450 FORI=7702TO8164STEP22:POKEI,WA:POKEI+
    C,NE:POKEI+21,WA:POKEI+C+21,NE:NEXT
                                    :rem 43
460 W=INT(RND(I)*5)+1               :rem 163
470 ONWGOSUB490,510,540             :rem 51
480 RETURN                          :rem 124
490 FORI=7795TO8095STEP22:POKEI+C,NE:POKE
    I,WA:POKEI+C+11,NE:POKEI+11,WA:NEXT
                                    :rem 60
500 RETURN                          :rem 117
510 FORI=7690TO7822STEP22:POKEI+C,NE:POKE
    I,WA:POKEI+C+NE,NE:POKEI+NE,WA:rem 21
520 POKEI+C+330,NE:POKEI+330,WA:POKEI+C+3
    31,NE:POKEI+331,WA:NEXT         :rem 134
530 FORI=7923TO7928:POKEI+C,NE:POKEI,WA:P
    OKEI+C+14,NE:POKEI+14,WA:NEXT:RETURN
                                    :rem 180
540 FORI=7712TO7822STEP22:POKEI+C,NE:POKE
    I,WA:POKEI+C+NE,NE:POKEI+NE,WA:NEXT
                                    :rem 140
```

```
550 FORI=7840TO8148STEP22:POKEI+C,NE:POKE
    I,WA:POKEI+C+9,NE:POKEI+9,WA:NEXT:RET
    URN                                 :rem 247
560 POKECO,15:IFPEEK(B)=28THENPOKEB,29
                                        :rem 77
570 POKEA,27:FORI=250TO115STEP-.3:POKES+2
    ,I:NEXT:POKES+2,0                   :rem 95
580 ML=ML-1:IFML=.THEN680               :rem 4
590 GOTO620                             :rem 111
600 POKEA,TR:POKEB,MA:FORI=1TO90:POKECO,I
    :POKES,150+I:POKES+1,150+I:POKES-1,15
    0+I                                 :rem 33
601 NEXT:POKES,0:POKES+1,0:POKES-1,0:POKE
    CO,152                              :rem 151
610 BO=100-VAL(TI$):IFBO<0THENBO=0:rem 11
620 PRINTCHR$(147):POKECO,104:PRINTCHR$(5
    ):SC=SC+BO                          :rem 124
630 PRINT"SCORE ";SC:PRINT              :rem 126
640 PRINT"MAYNERDS LEFT ";ML:PRINT:PRINT"
    BONUS ";BO                          :rem 242
650 PRINT:PRINT:PRINT:PRINTCHR$(15)"PRESS
     FIRE BUTTON TO{2 SPACES}CONTINUE"
                                        :rem 16
660 GOSUB390:IFFR=0THEN660              :rem 81
670 POKES,230:PRINTCHR$(147):POKECO,8:NM=
    NM+2:NC=NC+2:CL=NC:POKES,0:BO=0:GOTO1
    80                                  :rem 231
680 PRINTCHR$(147)CHR$(144):POKECO,30
                                        :rem 142
690 PRINT"SCORE ";SC:IFSC>HSTHENHS=SC
                                        :rem 146
700 PRINT:PRINT"+ HIGH SCORE ";HS:PRINT:P
    RINT:PRINT"PRESS THE FIRE BUTTON TO P
    LAY AGAIN"                          :rem 14
710 GOSUB390:IFFR=0THEN710              :rem 73
720 POKES,200:BO=0:SC=0:NC=1:NM=2:CL=NC:P
    RINTCHR$(147):ML=5:POKECO,8:POKES,0:G
    OTO180                              :rem 223
```

Program 3: React—64 Version

```
100 POKE53280,15:POKE53281,15           :rem 82
110 PRINT"{CLR}":POKE53280,15:POKE53281,1
    5                                   :rem 241
120 PRINT"{BLU}{10 DOWN}{2 RIGHT}LOADING
    {SPACE}CHARACTERS{6 F}PLEASE WAIT"
                                        :rem 150
130 PRINTCHR$(142):POKE52,48:POKE56,48:CL
    R                                   :rem 249
140 POKE56334,PEEK(56334)AND254:POKE1,PEE
    K(1)AND251                          :rem 182
150 FORI=0TO1024:POKEI+12288,PEEK(I+53248
    ):NEXT:POKE1,PEEK(1)OR4             :rem 86
160 POKE56334,PEEK(56334)OR1            :rem 68
170 POKE53272,(PEEK(53272)AND240)OR12
                                        :rem 45
180 FORI=12288TO12295:READA:POKEI,A:NEXT:
    DATA24,90,36,24,24,24,36,66         :rem 167
190 FORI=12504TO12671:READA:POKEI,A:NEXT
                                        :rem 214
200 DATA0,0,24,24,60,90,60,66           :rem 173
210 DATA60,66,165,129,165,154,66,60
                                        :rem 243
220 DATA255,129,165,129,189,165,189,255
                                        :rem 206
230 DATA0,126,126,126,126,126,126,0
                                        :rem 217
240 DATA170,255,85,255,170,255,85,255,0,0
    ,0,0,0,0,0,0                        :rem 62
250 DATA0,6,8,60,126,126,126,60         :rem 26
260 DATA24,60,126,255,255,255,60,60
                                        :rem 235
270 DATA56,60,254,255,255,254,60,56
                                        :rem 247
280 DATA60,60,255,255,255,126,60,24
                                        :rem 237
290 DATA28,60,127,255,255,127,60,28
                                        :rem 245
300 DATA0,0,56,40,8,20,34,127           :rem 171
310 DATA28,34,42,34,28,20,119,0         :rem 23
320 DATA219,195,36,153,153,36,195,219
                                        :rem 93
330 DATA75,75,75,75,180,180,180,180
                                        :rem 248
340 DATA126,102,66,126,24,36,195,66
                                        :rem 240
350 DATA60,66,189,255,255,189,66,60:rem 6
360 DATA0,0,56,68,146,68,56,0           :rem 196
370 DATA0,60,60,60,60,60,255,0          :rem 226
380 DATA129,195,231,255,255,231,195,129
                                        :rem 195
390 DATA0,102,102,0,66,102,60,24        :rem 59
400 FORI=12752TO12799:READA:POKEI,A:NEXT
                                        :rem 224
410 DATA171,171,173,173,181,181,213,213
                                        :rem 171
420 DATA195,195,0,24,24,0,195,195:rem 140
430 DATA255,145,145,159,249,137,137,255
                                        :rem 197
440 DATA0,0,151,146,242,146,151,0:rem 114
450 DATA165,36,231,24,24,231,36,165
                                        :rem 233
460 DATA195,231,126,60,60,126,231,195
                                        :rem 80
480 CLR:FORI=54272TO54296:POKEI,0:NEXT:PO
    KE54296,15:POKE54277,17:POKE54278,240
                                        :rem 156
490 POKE54276,33                        :rem 102
500 PRINT"{CLR}":PRINTTAB(12)"RRRRRRRRRR
    RR"                                 :rem 185
510 FORI=1TO7:PRINTTAB(12)"R{11 SPACES}R"
    :NEXT                               :rem 193
520 PRINTTAB(12)"RRRRRRRRRRRR E A C T"
                                        :rem 58
530 PRINTTAB(12)"RR"                    :rem 152
540 PRINTTAB(12)"R R"                   :rem 153
550 PRINTTAB(12)"R{2 SPACES}R"          :rem 154
560 PRINTTAB(12)"R{3 SPACES}R"          :rem 155
570 FORI=5TO7:PRINTTAB(12)"R"TAB(I+12)"R"
    :NEXT                               :rem 14
580 FORI=8TO15:POKE53280,15:POKE53281,I:F
    ORJ=1TO9                            :rem 222
590 POKE54273,J+2*I:POKE54272,I:NEXTJ:NEX
    TI:POKE54276,32                     :rem 129
600 PRINT:PRINT"{3 RIGHT}{3 DOWN}PRESS TH
    E FIRE BUTTON TO START"             :rem 89
610 A=1465:SM=28:ML=5                   :rem 171
620 C=54272:ER=32:MA=0:TR=30:CH=33:WA=31:
    PA=56321                            :rem 40
630 OP=127:TF=255:N1=128:N2=8:N3=16:N4=4:
    NE=1:SC=0:DIMJS(12):NM=2:NC=1:CL=NC
                                        :rem 249
640 JS(1)=-40:JS(2)=40:JS(4)=-1:JS(5)=-39
    :JS(6)=39:JS(8)=1:JS(9)=-41:JS(10)=41
                                        :rem 220
650 GOSUB840:IFFR=16THEN650             :rem 134
660 POKE54276,17:POKE54273,72:POKE54272,2
    00:POKE54276,16                     :rem 153
670 PRINTCHR$(147):POKE53280,0:POKE53281,
    0                                   :rem 167
680 POKE54276,17:POKE54273,81:POKE54273,1
    20:POKE54276,16:GOSUB860            :rem 245
```

```
690 A=1065:FORI=1TONM                    :rem 255
700 W=INT(RND(I)*999)+1:J=INT(RND(I)*14)+
    1:IFPEEK(1024+W)<>32THEN700          :rem 169
710 IFW+1024=ATHEN700                    :rem 180
715 POKE54276,17:POKE54273,40:POKE54272,4
    1:POKE54276,16                       :rem 104
720 POKEW+1024,28:POKEW+C+1024,J:NEXT
                                         :rem 182
730 FORI=1TONC:W=INT(RND(I)*999)+1:rem 37
740 W=INT(RND(I)*999)+1:J=INT(RND(I)*14)+
    1:K=INT(RND(I)*64)+1                 :rem 236
750 IFPEEK(1024+W)<>32THEN740            :rem 147
760 IFK>26ANDK<33ORK=0ORW+1024=ATHEN740
                                         :rem 104
770 POKE54276,17:POKE54273,34:POKE54272,7
    5:POKEW+1024,K:POKEW+C+1024,J        :rem 46
780 NEXT:POKE54276,16:TI$="000000"
                                         :rem 126
790 POKEA,MA:GOSUB850:B=A+JS(J1)         :rem 175
800 IFPEEK(B)=WAORPEEK(B)=TRORPEEK(B)=SMT
    HEN1000                              :rem 22
810 IFPEEK(B)=MATHEN830                  :rem 117
820 IFPEEK(B)<>ERTHENPOKE54276,17:POKE542
    73,40:CL=CL-NE:SC=SC+50:POKE54276,16
                                         :rem 118
825 IFCL=0THEN1040                       :rem 30
830 POKE54276,65:POKE54272,11:POKE54273,2
    :POKE54276,64:SC=SC+NE:POKEA,TR
                                         :rem 20
835 A=B:GOTO790                          :rem 115
840 P=PEEK(PA):FR=PAND16:RETURN          :rem 227
850 P=PEEK(PA):J1=15-(PAND15):RETURN
                                         :rem 170
860 TC=INT(RND(1)*14)+1:FORI=1024TO2023:P
    OKEI+C,TC:NEXT                       :rem 51
870 FORI=1024TO1063:POKEI,WA:POKEI+C,NE:P
    OKEI+960,WA:POKEI+C+960,NE:NEXT
                                         :rem 247
880 FORI=1064TO1984STEP40:POKEI,WA:POKEI+
    C,NE:POKEI+39,WA:POKEI+C+39,NE:NEXT
                                         :rem 66
890 W=INT(RND(1)*5)+1                    :rem 146
900 ONWGOSUB920,940,970                  :rem 61
910 RETURN                               :rem 122
920 FORI=1233TO1780STEP40:POKEI+C,NE:POKE
    I,WA:POKEI+C+11,NE:POKEI+11,WA:NEXT
                                         :rem 33
930 RETURN                               :rem 124
940 FORI=1044TO1284STEP40:POKEI+C,NE:POKE
    I,WA:POKEI+C+NE,NE:POKEI+NE,WA:rem 11
950 POKEI+C+330,NE:POKEI+330,WA:POKEI+C+3
    31,NE:POKEI+331,WA:NEXT              :rem 141
960 FORI=1504TO1516:POKEI+C,NE:POKEI,WA:P
    OKEI+C+14,NE:POKEI+14,WA:NEXT:RETURN
                                         :rem 163
970 FORI=1074TO1314STEP40:POKEI+C,NE:POKE
    I,WA:POKEI+C+NE,NE:POKEI+NE,WA:NEXT
                                         :rem 132
980 FORI=1440TO1920STEP40:POKEI+C,NE:POKE
    I,WA:POKEI+C+12,NE                   :rem 168
990 POKEI+12,WA:NEXT:RETURN              :rem 255
1000 IFPEEK(B)=28THENPOKEB,29            :rem 230
1010 POKEA,27:POKE54276,17:FORI=1TO10:POK
     E54273,RND(0)*200+5                 :rem 195
1020 POKE54272,RND(0)*100+10:NEXT:POKE542
     76,16:ML=ML-1:IFML=0THEN1130        :rem 21
1030 GOTO1070                            :rem 197
1040 POKEA,TR:POKEB,MA:POKE54276,17:FORI=
     1TO30:POKE54273,6*I                 :rem 146
1050 POKE54272,6*I:NEXT:POKE54276,16
                                         :rem 75
1060 BO=100-VAL(TI$):IFBO<0THENBO=0
                                         :rem 59
1070 PRINTCHR$(147)CHR$(158):SC=SC+BO
                                         :rem 146
1080 PRINTTAB(14)"{5 DOWN}SCORE ";SC
                                         :rem 201
1090 PRINTTAB(14)"{DOWN}MAYNERDS LEFT ";M
     L:PRINTTAB(14)"{DOWN}BONUS ";BO
                                         :rem 151
1100 PRINT"{7 DOWN}{5 RIGHT}PRESS FIRE BU
     TTON TO CONTINUE"                   :rem 50
1110 GOSUB840:IFFR=16THEN1110            :rem 214
1120 PRINTCHR$(147):NM=NM+2:NC=NC+2:CL=NC
     :BO=0:GOTO680                       :rem 31
1130 PRINTCHR$(147)CHR$(158)             :rem 48
1140 PRINTTAB(14)"{5 DOWN}SCORE ";SC:IFSC
     >HSTHENHS=SC                        :rem 155
1150 PRINTTAB(14)"{DOWN}+ HIGH SCORE ";HS
                                         :rem 211
1155 PRINT"{7 DOWN}{6 RIGHT}PRESS THE FIR
     E BUTTON TO PLAY"                   :rem 11
1160 GOSUB840:IFFR=16THEN1160            :rem 224
1170 BO=0:SC=0:NC=1:NM=2:CL=NC:PRINTCHR$(
     147):ML=5                           :rem 18
1180 GOTO680                             :rem 161
```

Multicolor Character Generator

(Article on page 124.)

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs," "A Beginner's Guide To Typing In Programs," and "The Automatic Proofreader" that appear before the Program Listings.

```
0 PRINT"{CLR}{RVS} MULTICOLOR CHARACTER";
  SPC(7);"GENERATOR"                     :rem 12
1 POKE36869,255:POKE52,28:POKE56,28:CLR:F
  ORA=7168TO7679:POKEA,PEEK(25600+A):NEXT
                                         :rem 70
2 S=7680:C=38400:M=7168:I=36879:DIMC$(15)
  :DEFFND(Q)=X+22*Y:FORA=828TO898:POKEA,0
  :NEXT                                  :rem 35
3 FORA=0TO15:READA$:C$(A)=A$:NEXT:PRINT"
  {BLK}";                                :rem 176
4 PRINT"{CLR}";:FORA=0TO7:FORB=0TO7
                                         :rem 38
5 POKEC+A+22*B,PEEK(828+A+8*B):POKES+A+22
  *B,A+8*B:NEXTB,A:GOTO9                 :rem 192
6 FORA=0TO7:PRINTTAB(8);"{RVS}-":NEXT:PRI
  NT"{RVS}********{X}":PRINT"
  {HOME}";:RETURN                        :rem 0
7 DATABLACK,WHITE,RED,CYAN,PURPLE,GREEN,B
  LUE,YELLOW,ORANGE,LT.OR.,PINK          :rem 197
8 DATALT.CYAN,LT.PUR.,LT.GRN.,LT.BLUE,LT.
  YEL.                                   :rem 173
9 GOSUB6:PRINT:PRINTTAB(11);"{RVS}COMMAND
  S":PRINT                               :rem 177
10 PRINTTAB(10)"{RVS}S-SCREEN":PRINTTAB(1
   0)"{RVS}B-BORDER":PRINTTAB(10)"{RVS}A-
   AUXILIARY"                            :rem 172
11 PRINTTAB(10);"{RVS}N-NEW CHAR":PRINT:P
   RINT:PRINT                            :rem 225
12 X=0:Y=0:POKES,230:POKEC,Q             :rem 206
```

```
13 FORA=ØTO7:PRINT"{RVS}";MID$(STR$(A),2)
   ;"-";C$(A),MID$(STR$(A+8),2); :rem 141
14 PRINT"-";C$(A+8):NEXT:PRINT:PRINT:GOTO
   2Ø                              :rem 214
15 SR=(PEEK(36879)AND24Ø)/16:PRINT"{RVS}S
   CREEN ";C$(SR)                  :rem 148
16 BR=PEEK(36879)AND7:PRINT"{RVS}BORDER "
   ;C$(BR)                         :rem 43
17 AX=(PEEK(36878)AND24Ø)/16:PRINT"{RVS}A
   UXIL. ";C$(AX):RETURN           :rem 136
18 FORA=ØTO63:IFPEEK(828+A)<2THENPOKE828+
   A,Q                             :rem 174
19 NEXT:RETURN                     :rem 195
2Ø GETA$:IFA$=""THEN2Ø             :rem 231
21 SC$="":IFA$="N"THEN5Ø           :rem 47
22 IFA$="S"THENINPUT"{RVS}SCREEN (Ø-15) "
   ;SC$:GOSUB26:POKEI,(PEEK(I)AND7)OR16*S
   C+8:GOSUB29                     :rem 116
23 IFA$="B"THENINPUT"{RVS}BORDER (Ø-7) ";
   SC$:GOSUB26:POKEI,(PEEK(I)AND248)+SC:G
   OSUB29                          :rem 48
24 IFA$="A"THENINPUT"{RVS}AUX. (Ø-15) ";S
   C$:GOSUB26:POKEI-1,16*SC:GOSUB29:rem Ø
25 GOSUB45:GOTO2Ø                  :rem 37
26 SC=VAL(SC$):IFSC>15THENSC=1     :rem 95
27 IFA$="B"ANDSC>7THENSC=Ø         :rem 48
28 RETURN                          :rem 74
29 PRINT"{RVS}{HOME}{2Ø DOWN}{22 SPACES}
   {UP}";                          :rem 129
3Ø IFA$<>"S"THENRETURN             :rem 119
31 IFSC=ØTHENPRINT"{WHT}":Q=1:GOSUB18:GOT
   O4                              :rem 19Ø
32 IFQ=1THENIFSC<>ØTHENQ=Ø:GOSUB18:PRINT"
   {BLK}":GOTO4                    :rem 3
33 RETURN                          :rem 7Ø
34 V=FND(Q):IFFL=1THENPOKES+V,IL:POKES+V+
   1,IL:POKEC+V,CL:POKEC+V+1,CL:RETURN
                                   :rem 2Ø8
35 POKES+V,X+Y*8:POKEC+V,PEEK(828+X+Y*8):
   RETURN                          :rem 2Ø1
36 IFFL=1ANDA$="{RIGHT}"THENX=X+1  :rem 7Ø
37 IFFL=1ANDA$="{LEFT}"THENX=X-1   :rem 2Ø1
38 IFX>7THENX=.                    :rem 185
39 IFY<ØTHENY=7                    :rem 188
4Ø IFX<ØTHENX=7:IFFL=1THENX=6      :rem 117
41 IFY>7THENY=.                    :rem 181
42 V=FND(Q):IL=PEEK(S+V):CL=PEEK(C+V):POK
   ES+V,23Ø:POKEC+V,Q              :rem 177
43 IFFL=1THENPOKES+V+1,23Ø:POKEC+V+1,Q
                                   :rem 75
44 RETURN                          :rem 72
45 IFA$="{RIGHT}"THENGOSUB34:X=X+1:GOSUB3
   6                               :rem 183
46 IFA$="{DOWN}"THENGOSUB34:Y=Y+1:GOSUB36
                                   :rem 174
47 IFA$="{LEFT}"THENGOSUB34:X=X-1:GOSUB36
                                   :rem 59
48 IFA$="{UP}"THENGOSUB34:Y=Y-1:GOSUB36
                                   :rem 5Ø
49 RETURN                          :rem 77
5Ø CH=X+8*Y:FL=1:FORA=M+8*(CH)TOM+8*(CH)+
   7:POKEA,Ø:NEXT:IL=174:CL=Q      :rem 51
51 FORA=M+8*CHTOM+8*CH+7:POKEA,Ø:NEXT
                                   :rem 25
52 PRINT"{CLR}{3 DOWN}";TAB(9);"{RVS}C-CH
   AR.{2 SPACES}DOT":PRINTTAB(9);"{RVS}A-
   AUXIL. DOT"                     :rem 141
53 PRINTTAB(9);"{RVS}B-BORDER DOT"
                                   :rem 251
54 PRINTTAB(9);"{RVS}S-SCREEN DOT":PRINTT
   AB(9);"{RVS}R-RETURN{4 SPACES}":PRINT"
   {HOME}";                        :rem 128
55 FORA=ØTO7:PRINT"{RVS}........":NEXT:X=
   Ø:Y=Ø:POKES,23Ø:POKES+1,23Ø     :rem 52
56 POKE7722,CH:PRINT:PRINT:GOSUB15:PRINT"
   {HOME}";:GOSUB6:FORA=ØTO4:POKE8185+A,2
   52:NEXT                         :rem 169
57 PRINT"{HOME}";TAB(19);"{RVS}[A]*
   [S]{DOWN}{3 LEFT}-{RIGHT}-{DOWN}
   {3 LEFT}[Z]*[X]";:POKE8184,48:POK
   E8190,48:POKE8191,Ø             :rem 25
58 PRINT"{HOME}";TAB(10);"{RVS}{DOWN}COMM
   ANDS":POKE38904,SR:POKE38905,SR
                                   :rem 142
59 PRINT"{HOME}{15 DOWN}";:FORA=ØTO3:PRIN
   T"{RVS}";A;C$(A),A+4;C$(A+4):NEXT
                                   :rem 214
6Ø PRINT:INPUT"{RVS}CHARACTER (Ø-7) ";SC$
   :A$="B":GOSUB26:SC=SC+8:POKE38442,SC:C
   R=SC:GOSUB29                    :rem 251
61 POKE828+CH,SC:PRINT"{7 UP}";:PRINT"
   {RVS}CHAR.{2 SPACES}";C$(SC-8) :rem 68
62 GETA$:IFA$=""THEN62             :rem 243
63 GOSUB45:PS=M+8*CH+Y:IFA$="R"THENFLAG=Ø
   :GOTO71                         :rem 231
64 IFA$="A"THENPOKEPS,PEEK(PS)OR2↑(7-X):P
   OKEPS,PEEK(PS)OR2↑(6-X)::CU=AX:GOSUB69
                                   :rem 61
65 IFA$="C"THENPOKEPS,PEEK(PS)OR2↑(7-X):P
   OKEPS,PEEK(PS)AND(255-2↑(6-X)):CU=CR-8
   :GOSUB69                        :rem 179
66 IFA$="B"THENPOKEPS,PEEK(PS)OR2↑(6-X):P
   OKEPS,PEEK(PS)AND(255-2↑(7-X)):CU=BR:G
   OSUB69                          :rem 77
67 IFA$="S"THENIL=174:POKEPS,PEEK(PS)AND(
   255-(2↑(6-X)+2↑(7-X))):CL=Q:GOSUB34:GO
   SUB7Ø                           :rem 94
68 GOTO62                          :rem 15
69 V=FND(A):POKES+V,127:POKEC+V,CU:POKES+
   V+1,127:POKEC+V+1,CU            :rem 12
7Ø X=X+2:GOSUB36:RETURN            :rem 238
71 PRINT"{CLR}{RVS}";M+8*CH;"TO";M+8*CH+7
   :PRINT:FORA=ØTO7                :rem 18
72 PRINT"{RVS}";PEEK(M+CH*8+A):NEXT:PRINT
   :PRINT"{RVS}";I;PEEK(I)         :rem 169
73 PRINT"{RVS}";I-1;PEEK(I-1):PRINT"{RVS}
   ";C;CR:PRINT"{RVS}";S;CH        :rem 99
74 PRINT:PRINT:PRINT"{RVS}HIT A KEY":POKE
   198,Ø:WAIT198,1:GOTO4           :rem 1Ø3
```

Haunted Mansion

(Article on page 62.)

Program 1:

Haunted Mansion—VIC Version

```
1ØØ IFPEEK(44)<32THENPOKE56,28:POKE52,28
                                   :rem 1ØØ
1Ø5 POKE36879,8:PRINT"{CLR}{GRN}{3 DOWN}*
   ***{RVS}HAUNTED{2 SPACES}HOUSE{OFF}**
   **";                            :rem 229
11Ø FORI=7168TO7679:POKEI,PEEK(256ØØ+I):N
   EXT                             :rem 147
12Ø FORI=832TO936:READA:POKEI,A:NEXT
                                   :rem 17
13Ø FORI=7168+35*8TO7168+45*8+7:READA:POK
   EI,A:NEXT                       :rem 2Ø4
14Ø FORI=7168+27*8TO7168+31*8+7:READA:POK
   EI,A:NEXT                       :rem 2Ø1
15Ø FORI=7168+58*8TO7168+62*8+7:READA:POK
   EI,A:NEXT                       :rem 21Ø
```

```
152 SC=4*(PEEK(36866)AND128)+64*(PEEK(368
    69)AND112):REM FIND SCREEN RAM
                                    :rem 231
153 CM=37888+4*(PEEK(36866)AND128)-SC:REM
     FIND COLOR RAM MINUS SCREEN RAM
                                    :rem 208
155 SH=36876:SL=36874:V=36878:O=0:P=1:Q=2
    2:DIMA(13)                      :rem 164
160 GOSUB800                        :rem 175
165 GOSUB900                        :rem 181
170 POKE36869,PEEK(36869)AND240OR15
                                    :rem 249
175 GOSUB1000:RN=RN+1               :rem 241
200 CL=SC+429                       :rem 190
210 SYS832                           :rem 47
215 TL=CL:Z=TL:ONPEEK(830)GOSUB301,300,30
    3,300,305,300,307,300           :rem 185
220 CL=Z:POKESH,220:POKEV,2:GOSUB400
                                    :rem 233
225 POKESH,0:POKESL,0:POKEV,0:IFDFTHEN500
                                    :rem 178
230 POKETL,32:POKECL,58:POKECM+CL,3+CF
                                     :rem 76
232 GOSUB700:IFCC=1THENFORX=1TO1500:NEXT:
    GOTO170                         :rem 52
235 GOSUB600:IFDFTHEN500           :rem 199
240 GOTO210                         :rem 98
300 RETURN                         :rem 115
301 Z=Z-Q:RETURN                    :rem 29
303 Z=Z+P:RETURN                    :rem 28
305 Z=Z+Q:RETURN                    :rem 31
307 Z=Z-P:RETURN                    :rem 34
400 REM COLLISION CHECK            :rem 130
405 IFPEEK(CL)=44ORPEEK(CL)=45ORPEEK(CL)=
    35THENCL=TL:RETURN              :rem 30
407 IFCFANDCL<SC+439ANDCL>SC+419THEN2000
                                    :rem 162
410 IFCFANDPEEK(CL)=60THENCL=TL:RETURN
                                    :rem 221
415 IFPEEK(CL)=60THENCF=4:POKEV,10:FORI=1
    TO50:NEXT:RETURN               :rem 185
420 IFPEEK(CL)=61ORPEEK(CL)=59THEN1800
                                     :rem 23
425 IFPEEK(CL)=31THEN1900          :rem 201
430 RETURN                         :rem 119
500 REM GOTCHA!                     :rem 80
510 PRINT"{CLR}{BLU}{DOWN}{2 RIGHT}ANOTHE
    R VICTIM!"                      :rem 98
520 POKE36869,PEEK(36869)AND240OR8:POKE36
    879,27                         :rem 209
525 PRINT"{DOWN}{RIGHT}SKILL LEVEL"AA
                                    :rem 20
530 PRINT"{DOWN}{RIGHT}ROUND"RN"SCORE"SR
                                    :rem 36
540 PRINT"{DOWN}{RIGHT}PLAY AGAIN?
    {2 SPACES}{RVS}Y{OFF} OR {RVS}N{OFF}"
                                    :rem 253
550 GETA$:IFA$=""THEN550            :rem 87
560 IFA$="Y"THENCF=0:GOTO570       :rem 157
562 IFA$<>"N"THEN550               :rem 102
565 END                            :rem 119
570 RN=0:SR=0:DF=0                  :rem 38
575 GOTO165                        :rem 118
600 REM MOVE SPIRITS               :rem 223
610 I=INT(RND(1)*(AA*2))+1         :rem 116
620 TL=A(I):Z=TL:POKEA(I),32       :rem 150
630 ONINT(RND(1)*4)+1GOSUB301,303,305,307
                                    :rem 242
635 IFZ>SC+419ANDZ<SC+439THEN660   :rem 185
640 IFPEEK(Z)=58THEN1900           :rem 156
650 IFPEEK(Z)=32THENA(I)=Z          :rem 61
660 POKEA(I),31:POKECM+A(I),4:RETURN
                                    :rem 175
700 PRINT"{HOME}{21 DOWN}{RIGHT}{WHT}ROUN
    D"RN"SCORE"SR"{LEFT} ";:RETURN
                                    :rem 197
800 PRINT"{CLR}YOU ARE ENTERING A
    {4 SPACES}WITCH'S HAUNTED HOUSE.";
                                     :rem 93
815 PRINT"THE WITCH IS AWAY,{4 SPACES}FLY
    ING ON HER BROOM.{2 SPACES}";:rem 246
820 PRINT"SHE HAS CAPTURED{6 SPACES}YELLO
    W CATS AND WILL{2 SPACES}TURN THEM IN
    TO WITCH{2 SPACES}";           :rem 252
825 PRINT"CATS UNLESS YOU RESCUETHEM."
                                    :rem 149
830 PRINT"GUIDE YOURSELF WITH A JOYSTICK.
     PICK UP ONE CAT AT A TIME. BRING
    {2 SPACES}";                   :rem 212
835 PRINT"IT TO THE BOTTOM ROW. WHILE CAR
    RYING A CAT, YOU WILL TURN YELLOW. ";
                                    :rem 109
840 PRINT"YOU CAN PICK UP ONLY{2 SPACES}O
    NE CAT AT A TIME, ANDYOU GET POINTS F
    OR{4 SPACES}";                 :rem 228
845 PRINT"EACH CAT YOU SAVE.{4 SPACES}WHE
    N YOU SAVE 10 CATS,YOU GET A NEW HOUS
    E.{2 SPACES}";                 :rem 192
847 PRINT"{4 SPACES}PRESS ANY KEY
    {5 SPACES}";                    :rem 13
850 GETA$:IFA$=""THEN850            :rem 93
855 PRINT"G{P}F YOU RUN INTO A BAT OR GHO
    ST, YOU'LL JUMP IN FEAR, DROP ANY
    {5 SPACES}";                   :rem 215
860 PRINT"CAT YOU ARE CARRYING{2 SPACES}A
    ND{2 SPACES}LOSE POINTS."      :rem 140
865 PRINT"THE HOUSE IS HAUNTED{2 SPACES}B
    Y EVIL SPIRITS{7 SPACES}FLOATING ALON
    G THE{4 SPACES}HALLWAYS."      :rem 176
866 PRINT"IF YOU TOUCH A SPIRIT,YOU LOSE
    {SPACE}THE GAME!"               :rem 24
867 PRINT" (BOTTOM ROW IS SAFE) ";
                                    :rem 138
870 PRINT"{RED}HIGHER SKILL LEVELS
    {3 SPACES}SCORE MORE POINTS BUT ARE H
    ARDER.{11 SPACES}{OFF}";       :rem 141
890 RETURN                         :rem 129
900 PRINT"ENTER SKILL LEVEL 1-6"   :rem 115
920 GETA$:IFA$=""THEN920            :rem 89
930 AA=VAL(A$):IFAA<1ORAA>6THEN920:rem 13
940 RETURN                         :rem 125
1000 POKE36879,8:PRINT"{CLR}"       :rem 3
1003 PRINT">{YEL}>.>.>>{BLU}-,{YEL}>.>>>>
     >>>>.>";                      :rem 28
1005 PRINT">>>>>>{BLU}-##,{YEL}>.>>$%>.>>
     >>";                          :rem 55
1010 PRINT">>>.>{BLU}-####,{YEL}>>&[£'>>
     .>>";                         :rem 60
1015 PRINT">>.>{BLU}-######,{YEL}>(]↑)>>>
     >>";                          :rem 35
1020 PRINT">>>{BLU}-########,{YEL}>*+>.>>
     >>";                          :rem 174
1025 PRINT">>{BLU}-##########,{YEL}>>>>>>
     >>";                          :rem 180
1030 PRINT">{BLU}-############,{YEL}>>>.>
     >>";                          :rem 106
1035 PRINT">{BLU}##############,{YEL}>.>>
     >>";                           :rem 74
1040 PRINT">{BLU}###############,{YEL}>>>
     .>";                          :rem 43
1045 PRINT">{BLU}################,{WHT}>>
     >>";                          :rem 140
```

```
1050 PRINT">{BLU}################,{WHT}>
     >>";                          :rem 109
1055 PRINT">{BLU}################,{WHT}
     >>";                          :rem 87
1060 PRINT">{BLU}##################,
     {WHT}>";                      :rem 56
1065 PRINT">{BLU}####################,
     {WHT}";                       :rem 34
1075 PRINT">{BLU}####################
     {WHT}";                       :rem 26
1080 PRINT">{BLU}####################
     {WHT}";                       :rem 22
1085 PRINT">{BLU}####################
     {WHT}";                       :rem 27
1090 PRINT">{BLU}####################
     {WHT}";                       :rem 23
1092 PRINT">{BLU}####################
     {WHT}";                       :rem 25
1093 PRINT">{BLU}####################
     {WHT}";                       :rem 26
1200 REM BUILD MAZE                :rem 68
1205 A(0)=2:A(1)=-44:A(2)=-2:A(3)=44:WL=3
     5:HL=32:A=SC+420               :rem 7
1210 POKEA,4                       :rem 148
1220 J=INT(RND(1)*4):X=J           :rem 101
1230 B=A+A(J):IFPEEK(B)=WLTHENPOKEB,J:POK
     EA+A(J)/2,HL:A=B:GOTO1220     :rem 8
1240 J=(J+1)*-(J<3):IFJ<>XTHEN1230
                                   :rem 128
1250 J=PEEK(A):POKEA,HL:IFJ<4THENA=A-A(J)
     :GOTO1220                     :rem 34
1260 FORI=SC+114TOSC+422STEP22:POKEI,32:P
     OKEI+7,32:NEXT                :rem 138
1270 FORI=SC+74TOSC+426STEP22:POKEI,32:NE
     XT                            :rem 191
1280 FORI=SC+282TOSC+436STEP22:POKEI,32:N
     EXT                           :rem 242
1290 FORI=SC+213TOSC+433STEP22:POKEI,32:N
     EXT                           :rem 234
1291 FORI=SC+200TOSC+212:POKEI,32:NEXT
                                   :rem 66
1292 FORI=SC+332TOSC+350:POKEI,32:POKEI+8
     8,32:NEXT                     :rem 42
1300 REM PLACE GAME CHARACTERS      :rem 7
1310 REMPLACE GHOSTS               :rem 230
1320 FORI=PTO3*AA                   :rem 5
1330 X=INT(RND(1)*374)+SC+22       :rem 22
1340 BL=0:GOSUB1700:IFBLTHEN1330   :rem 146
1350 POKEX,59:POKECM+X,1:NEXT      :rem 60
1400 REMPLACE BATS                 :rem 56
1420 FORI=PTO3*AA                   :rem 6
1430 X=INT(RND(1)*374)+SC+22       :rem 23
1440 BL=0:GOSUB1700:IFBLTHEN1430   :rem 148
1450 POKEX,61:POKECM+X,5:NEXT      :rem 58
1500 REMPLACE CATS                 :rem 58
1520 CC=11:FORI=PTO10              :rem 232
1530 X=INT(RND(1)*374)+SC+22       :rem 24
1540 BL=0:GOSUB1700:IFBLTHEN1530   :rem 150
1550 POKEX,60:POKECM+X,7:NEXT      :rem 60

1600 REMPLACE SPIRITS              :rem 62
1620 FORI=PTOAA*2                   :rem 7
1630 X=INT(RND(1)*374)+SC+22       :rem 25
1640 IFPEEK(X)<>32THEN1630          :rem 0
1650 POKEX,31:POKECM+X,4:A(I)=X:NEXT:RETU
     RN                            :rem 252
1700 IF(PEEK(X)<>32)OR(PEEK(X+P)<>32ANDPE
     EK(X+P)<>35)THENBL=1          :rem 152
1710 IF(PEEK(X-P)<>32ANDPEEK(X-P)<>35)OR(
     PEEK(X+Q)<>32ANDPEEK(X+Q)<>35)THENBL
     =1                            :rem 24
1720 IF(PEEK(X-Q)<>32ANDPEEK(X-Q)<>35)THE
     NBL=1                          :rem 1
1730 RETURN                        :rem 171
1800 REM SCARED!                   :rem 128
1810 IFCF=OTHEN1840                :rem 106
1820 X=INT(RND(1)*374)+SC+22        :rem 26
1830 IFPEEK(X)<>32THEN1820          :rem 2
1835 POKEX,60:POKECM+X,7:CF=0:SR=SR-2*AA↑
     2:IFSR<OTHENSR=0              :rem 205
1840 POKETL,32:POKECL,58:POKECL+CM,1:POKE
     SL,0:POKESH,180:POKEV,9       :rem 62
1845 FORI=1TO400:NEXT              :rem 32
1850 TL=CL:Z=TL:ONINT(RND(1)*4)+1GOSUB301
     ,303,305,307                  :rem 62
1860 CL=Z:SR=SR-AA↑2:IFSR<OTHENSR=0
                                   :rem 78
1870 GOTO400                       :rem 157
1900 REM GOTCHA! SOUND             :rem 14
1905 POKETL,32:POKECL,58:POKECM+CL,4:DF=1
                                   :rem 5
1910 POKEV,5:POKESH,0:FORI=1TO4:POKESL,25
     5:FORX=1TO150:NEXT:POKESL,180:FORX=1
     TO75:NEXT                     :rem 101
1913 IFI=1ORI=3THENPOKECL,31:GOTO1920
                                   :rem 42
1914 POKECL,58                     :rem 38
1920 POKESL,0:FORX=1TO200:NEXT:NEXT:FORX=
     1TO500:NEXT:RETURN            :rem 182
2000 REM LINE UP SAVED CAT         :rem 190
2010 X=SC+500:POKEX-CC,60:POKECM+X-CC,7:C
     C=CC-1:SR=SR+10*AA↑2:CF=0     :rem 255
2020 POKEV,10:FORI=1TO50:NEXT:RETURN
                                   :rem 73

9000 DATA120,8,72,152,72,138,72,173,19,14
     5,72,173,34,145,72,169,0,141,62,3,14
     1,63,3,169                    :rem 241
9010 DATA127,141,34,145,173,32,145,73,255
     ,41,128,42,8,169,195,141,19,145,173,
     17,145,73                     :rem 207
9020 DATA255,41,60,74,74,40,42,168,41,16,
     201,16,208,3,141,63,3,152,41,15,162,
     0,232,224                     :rem 159
9030 DATA9,240,8,221,160,3,208,246,142,62
     ,3,104,141,34,145,104,141,19,145,104
     ,170,104                      :rem 109
9040 DATA168,104,40,88,96,2,3,1,5,4,12,8,
     10                            :rem 105
10000 DATA255,255,255,255,255,255,255,255
                                   :rem 31
10010 DATA0,0,0,0,0,15,63,255      :rem 155
10015 DATA0,0,0,0,0,240,252,255     :rem 0
10020 DATA1,1,3,3,7,7,7,7          :rem 229
10030 DATA128,128,192,192,224,224,224,224
                                   :rem 16
10040 DATA7,7,7,7,3,3,1,1          :rem 231
10050 DATA224,224,224,224,192,192,128,128
                                   :rem 18
10060 DATA255,63,15,0,0,0,0,0      :rem 160
10070 DATA255,252,240,0,0,0,0,0     :rem 1
10080 DATA128,192,224,240,248,252,254,255
                                   :rem 26
10090 DATA1,3,7,15,31,63,127,255   :rem 76
10100 DATA255,255,255,255,250,246,244,224
                                   :rem 21
10110 DATA255,255,191,63,15,15,7,63
                                   :rem 233
10120 DATA240,249,240,228,0,252,255,255
                                   :rem 170
10130 DATA255,255,127,35,1,112,63,255
                                   :rem 71
```

```
10140 DATA0,34,0,8,0,0,28,0          :rem 61
10150 DATA56,84,56,16,124,186,40,108
                                     :rem 33
10160 DATA62,42,62,28,28,28,60,120
                                     :rem 179
10170 DATA40,124,85,125,57,57,61,127
                                     :rem 32
10180 DATA0,16,124,254,214,130,0,0
                                     :rem 156
10190 DATA0,0,0,0,0,0,0,0            :rem 201
```

Program 2:

Haunted Mansion—64 Version

```
100 POKE52,48:POKE56,48:CLR          :rem 70
102 POKE53280,0:POKE53281,0          :rem 232
105 PRINT"{CLR}{7}{3 DOWN}*************
    {RVS}HAUNTED{2 SPACES}HOUSE{OFF}*****
    ********";                       :rem 119
107 PRINT"{13 DOWN}{9 SPACES}REDEFINING
    {2 SPACES}CHARACTERS"            :rem 1
108 POKE56334,PEEK(56334)AND254:POKE1,PEE
    K(1)AND251                       :rem 186
110 FORI=0TO511:POKE12288+I,PEEK(53248+I)
    :NEXT                            :rem 224
115 POKE1,PEEK(1)OR4:POKE56334,PEEK(56334
    )OR1                             :rem 134
120 FORI=832TO936:READA:POKEI,A:NEXT
                                     :rem 17
130 FORI=12288+35*8TO12288+45*8+7:READA:P
    OKEI,A:NEXT                      :rem 42
140 FORI=12288+27*8TO12288+31*8+7:READA:P
    OKEI,A:NEXT                      :rem 39
150 FORI=12288+58*8TO12288+62*8+7:READA:P
    OKEI,A:NEXT                      :rem 48
152 SC=1024                          :rem 50
153 CM=54272                         :rem 106
155 SH=54273:SL=54272:V=54296:WF=54276:O=
    0:P=1:Q=40:DIMA(13):POKEV,15     :rem 250
157 POKESL+5,17:POKESL+6,241         :rem 139
160 GOSUB800                         :rem 175
165 GOSUB900                         :rem 181
170 POKE53272,(PEEK(53272)AND240)+12
                                     :rem 183
175 GOSUB1000:RN=RN+1                :rem 241
200 CL=SC+859                        :rem 197
210 JP=15-PEEK(56320)AND15:IFJP=8THENJP=3
    :GOTO215                         :rem 200
211 IFJP=2THENJP=5:GOTO215           :rem 114
212 IFJP=4THENJP=7:GOTO215           :rem 119
213 IFJP=1THEN215                    :rem 244
214 JP=2                             :rem 160
215 TL=CL:Z=TL:ONJPGOSUB301,300,303,300,3
    05,300,307,300                   :rem 66
220 CL=Z:POKEV,15:POKESH,50:POKEWF,17:GOS
    UB400:POKEWF,16                  :rem 33
225 IFDFTHEN500                      :rem 118
230 POKETL,32:POKECL,58:POKECM+CL,3+CF
                                     :rem 76
232 GOSUB700:IFCC=1THENFORX=1TO1500:NEXT:
    GOTO170                          :rem 52
235 GOSUB600:IFDFTHEN500             :rem 199
240 GOTO210                          :rem 98
300 RETURN                           :rem 115
301 Z=Z-Q:RETURN                     :rem 29
303 Z=Z+P:RETURN                     :rem 28
305 Z=Z+Q:RETURN                     :rem 31
307 Z=Z-P:RETURN                     :rem 34
400 REM COLLISION CHECK              :rem 130
405 IFPEEK(CL)=44ORPEEK(CL)=45ORPEEK(CL)=
    35THENCL=TL:RETURN               :rem 30
407 IFCFANDCL<SC+873ANDCL>SC+845THEN2000
                                     :rem 167
410 IFCFANDPEEK(CL)=60THENCL=TL:RETURN
                                     :rem 221
415 IFPEEK(CL)=60THENCF=4:POKEWF,33:FORI=
    1TO100:NEXT:RETURN               :rem 49
420 IFPEEK(CL)=61ORPEEK(CL)=59THEN1800
                                     :rem 23
425 IFPEEK(CL)=31THEN1900            :rem 201
430 RETURN                           :rem 119
500 REM GOTCHA!                      :rem 80
510 PRINT"{CLR}{7}{DOWN}{12 RIGHT}ANOTH
    ER VICTIM!"                      :rem 255
520 POKE53272,21                     :rem 88
525 PRINT"{DOWN}{13 RIGHT}SKILL LEVEL"AA
                                     :rem 112
530 PRINT"{DOWN}{11 RIGHT}ROUND"RN"SCORE"
    SR                               :rem 70
540 PRINT"{DOWN}{10 RIGHT}PLAY AGAIN?
    {2 SPACES}{RVS}Y{OFF} OR {RVS}N{OFF}"
                                     :rem 2
550 GETA$:IFA$=""THEN550             :rem 87
560 IFA$="Y"THENCF=0:GOTO570         :rem 157
562 IFA$<>"N"THEN550                 :rem 102
565 SYS2048                          :rem 109
570 RN=0:SR=0:DF=0                   :rem 38
575 GOTO165                          :rem 118
600 REM MOVE SPIRITS                 :rem 223
610 I=INT(RND(1)*(AA*2))+1           :rem 116
620 TL=A(I):Z=TL:POKEA(I),32         :rem 150
630 ONINT(RND(1)*4)+1GOSUB301,303,305,307
                                     :rem 242
635 IFZ>SC+845ANDZ<SC+873THEN660     :rem 190
640 IFPEEK(Z)=58THEN1900             :rem 156
650 IFPEEK(Z)=32THENA(I)=Z           :rem 61
660 POKEA(I),31:POKECM+A(I),4:RETURN
                                     :rem 175
700 PRINT"{HOME}{23 DOWN}{10 RIGHT}{WHT}R
    OUND"RN"SCORE"SR"{LEFT} ";:RETURN
                                     :rem 236
800 PRINT"{CLR}YOU WILL ENTER A WITCH'S H
    AUNTED HOUSE. ";                 :rem 223
815 PRINT"{DOWN}THE WITCH IS AWAY, FLYING
     ON HER BROOM. ";                :rem 7
820 PRINT"{DOWN}SHE HAS CAPTURED YELLOW C
    ATS AND WILL{3 SPACES}";         :rem 221
825 PRINT"{DOWN}TURN THEM INTO WITCH CATS
     UNLESS YOU{4 SPACES}{DOWN}RESCUE THE
    M."                              :rem 231
830 PRINT"{DOWN}GUIDE YOURSELF WITH A JOY
    STICK. PICK UP ";                :rem 134
832 PRINT"{DOWN}ONE CAT AT A TIME. BRING
    {SPACE}IT TO THE{6 SPACES}";     :rem 58
835 PRINT"{DOWN}BOTTOM ROW.{2 SPACES}WHIL
    E CARRYING A CAT, YOU{2 SPACES}";
                                     :rem 210
837 PRINT"{DOWN}WILL TURN YELLOW.
    {2 SPACES}YOU CAN PICK UP ONLY ";
                                     :rem 39
840 PRINT"{DOWN}ONE CAT AT A TIME, AND YO
    U GET POINTS{3 SPACES}";         :rem 49
845 PRINT"{DOWN}FOR EACH CAT YOU SAVE. WH
    EN YOU SAVE 10 {DOWN}CATS, YOU GET A
    {SPACE}NEW HOUSE."               :rem 142
847 PRINT: PRINT"{13 SPACES}PRESS ANY KEY
    ";                               :rem 212
850 GETA$:IFA$=""THEN850             :rem 93
855 PRINT"{CLR}IF YOU RUN INTO A BAT OR G
    HOST, YOU'LL{2 SPACES}";         :rem 34
```

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860 PRINT"{DOWN}JUMP IN FEAR, DROP ANY CA
    T YOU ARE{6 SPACES}{DOWN}CARRYING AND
     LOSE POINTS."                  :rem 232
865 PRINT"{DOWN}THE HOUSE IS ALSO HAUNTED
     BY EVIL{7 SPACES}";            :rem 196
866 PRINT"{DOWN}SPIRITS FLOATING ALONG TH
    E HALLWAYS."                    :rem 237
867 PRINT"{DOWN}IF YOU TOUCH A SPIRIT, YO
    U LOSE THE{5 SPACES}{DOWN}GAME!"
                                    :rem 59
868 PRINT"{DOWN}(BOTTOM ROW IS SAFE) "
                                    :rem 97
870 PRINT"{YEL}{DOWN}HIGHER SKILL LEVELS
    {SPACE}SCORE MORE POINTS{3 SPACES}
    {DOWN}BUT ARE HARDER.{OFF}"     :rem 246
890 RETURN                          :rem 129
900 PRINT"{6}{DOWN}ENTER SKILL LEVEL 1-
    6"                              :rem 29
920 GETA$:IFA$=""THEN920            :rem 89
930 AA=VAL(A$):IFAA<1ORAA>6THEN920:rem 13
940 RETURN                          :rem 125
1000 POKE53280,0:POKE53281,0:PRINT"{CLR}"
                                    :rem 180
1003 PRINT">{YEL}>.>.>>>>>>>>>>>>>{BLU}-
     ,{YEL}>.>>>>>>>>>.>>>>>>>";    :rem 120
1005 PRINT">>>>>>>.>>.>>>>>>>{BLU}-##,
     {YEL}>.>>$%>.>>>>.>>>>>";      :rem 99
1010 PRINT">>>>.>>>>>>>>>>.>{BLU}-####,
     {YEL}>>&[£'>>.>>>>>>>>";       :rem 136
1015 PRINT">>>>>>>>.>>>>>>>>{BLU}-######,
     {YEL}>(]↑)>.>>>.>>>>>";        :rem 95
1020 PRINT">>>>>>>>>>.>>>>{BLU}-########,
     {YEL}>*+>.>>>>>>>>>>";         :rem 250
1025 PRINT">>>>>.>>>>>>>>{BLU}-##########
     ,{YEL}>>>.>>>>>>>.>>";         :rem 224
1030 PRINT">>>>>>>>>>>>>{BLU}-###########
     #,{YEL}>>>.>>>>>>>>>";         :rem 198
1035 PRINT">>>.>>>>>.>>{BLU}-############
     ##,{YEL}>.>>>>>>.>>>";         :rem 101
1040 PRINT">>.>>>>>>>>{BLU}-############
     ###,{YEL}>>>.>>>>>>>";         :rem 75
1045 PRINT">>>>>>>>>>{BLU}-#############
     ####,{WHT}>>>>>>>>>>";         :rem 161
1050 PRINT">>>>>>>>>{BLU}-##############
     #####,{WHT}>>>>>>>>>";         :rem 103
1055 PRINT">>>>>>>>{BLU}-###############
     ######,{WHT}>>>>>>>>";         :rem 54
1060 PRINT">>>>>>>{BLU}-################
     #######,{WHT}>>>>>>>";         :rem 252
1065 PRINT">>>>>>{BLU}-#################
     ########,{WHT}>>>>>>";         :rem 203
1075 PRINT">>>>>{BLU}-##################
     #########{WHT}>>>>>>";         :rem 168
1080 PRINT">>>>>{BLU}###################
     #########{WHT}>>>>>>";         :rem 154
1085 PRINT">>>>>{BLU}###################
     #########{WHT}>>>>>>";         :rem 159
1090 PRINT">>>>>{BLU}###################
     #########{WHT}>>>>>>";         :rem 155
1092 PRINT">>>>>{BLU}###################
     #########{WHT}>>>>>>";         :rem 157
1093 PRINT">>>>>{BLU}###################
     #########{WHT}>>>>>>";         :rem 158
1094 PRINT">>>>>{BLU}###################
     #########{WHT}>>>>>>";         :rem 159
1095 PRINT">>>>>{BLU}###################
     #########{WHT}>>>>>>";         :rem 160
1200 REM BUILD MAZE                 :rem 68
1205 A(0)=2:A(1)=-80:A(2)=-2:A(3)=80:WL=3
     5:HL=32:A=SC+846               :rem 19
1210 POKEA,4                        :rem 148
1220 J=INT(RND(1)*4):X=J            :rem 101
1230 B=A+A(J):IFPEEK(B)=WLTHENPOKEB,J:POK
     EA+A(J)/2,HL:A=B:GOTO1220      :rem 8
1240 J=(J+1)*-(J<3):IFJ<>XTHEN1230
                                    :rem 128
1250 J=PEEK(A):POKEA,HL:IFJ<4THENA=A-A(J)
     :GOTO1220                      :rem 34
1260 FORI=SC+216TOSC+856STEP40:POKEI,32:P
     OKEI+7,32:NEXT                 :rem 152
1270 FORI=SC+140TOSC+860STEP40:POKEI,32:N
     EXT                            :rem 235
1280 FORI=SC+372TOSC+852STEP40:POKEI,32:P
     OKEI+15,32:NEXT                :rem 200
1290 FORI=SC+489TOSC+849STEP40:POKEI,32:P
     OKEI+21,32:NEXT                :rem 213
1291 FORI=SC+372TOSC+387:POKEI,32:NEXT
                                    :rem 89
1292 FORI=SC+489TOSC+510:POKEI,32:NEXT
                                    :rem 87
1293 FORI=SC+687TOSC+712:POKEI,32:POKEI+1
     60,32:NEXT                     :rem 97
1300 REM PLACE GAME CHARACTERS      :rem 7
1310 REMPLACE GHOSTS                :rem 230
1320 FORI=PTO3*AA                   :rem 5
1330 X=INT(RND(1)*680)+SC+40        :rem 22
1340 BL=0:GOSUB1700:IFBLTHEN1330    :rem 146
1350 POKEX,59:POKECM+X,1:NEXT       :rem 60
1400 REMPLACE BATS                  :rem 56
1420 FORI=PTO3*AA                   :rem 6
1430 X=INT(RND(1)*680)+SC+40        :rem 23
1440 BL=0:GOSUB1700:IFBLTHEN1430    :rem 148
1450 POKEX,61:POKECM+X,5:NEXT       :rem 58
1500 REMPLACE CATS                  :rem 58
1520 CC=11:FORI=PTO10               :rem 232
1530 X=INT(RND(1)*680)+SC+40        :rem 24
1540 BL=0:GOSUB1700:IFBLTHEN1530    :rem 150
1550 POKEX,60:POKECM+X,7:NEXT       :rem 60
1600 REMPLACE SPIRITS               :rem 62
1620 FORI=PTOAA*2                   :rem 7
1630 X=INT(RND(1)*680)+SC+40        :rem 25
1640 IFPEEK(X)<>32THEN1630          :rem 0
1650 POKEX,31:POKECM+X,4:A(I)=X:NEXT:RETU
     RN                             :rem 252
1700 IF(PEEK(X)<>32)OR(PEEK(X+P)<>32ANDPE
     EK(X+P)<>35)THENBL=1           :rem 152
1710 IF(PEEK(X-P)<>32ANDPEEK(X-P)<>35)OR(
     PEEK(X+Q)<>32ANDPEEK(X+Q)<>35)THENBL
     =1                             :rem 24
1720 IF(PEEK(X-Q)<>32ANDPEEK(X-Q)<>35)THE
     NBL=1                          :rem 1
1730 RETURN                         :rem 171
1800 REM SCARED!                    :rem 128
1810 IFCF=0THEN1840                 :rem 106
1820 X=INT(RND(1)*680)+SC+40        :rem 26
1830 IFPEEK(X)<>32THEN1820          :rem 2
1835 POKEX,60:POKECM+X,7:CF=0:SR=SR-2*AA↑
     2:IFSR<0THENSR=0               :rem 205
1840 POKETL,32:POKECL,58:POKECL+CM,1
                                    :rem 206
1843 FORI=15TO1STEP-1:POKESL,100:POKESH,1
     00:POKEWF,33:POKEV,I           :rem 99
1844 FORII=1TO25:NEXTII,I           :rem 66
1845 FORI=1TO400:NEXT:POKEWF,32     :rem 183
1850 TL=CL:Z=TL:ONINT(RND(1)*4)+1GOSUB301
     ,303,305,307                   :rem 62
1860 CL=Z:SR=SR-AA↑2:IFSR<0THENSR=0
                                    :rem 78
1870 GOTO400                        :rem 157
1900 REM GOTCHA! SOUND              :rem 14
1905 POKETL,32:POKECL,58:POKECM+CL,4:DF=1
                                    :rem 5
```

```
1910 POKESL,100:FORI=1TO4:POKEWF,17:POKES
     H,25:FORX=1TO150:NEXT:POKEWF,16
                                    :rem 104
1911 FORX=1TO75:NEXT                 :rem 1
1913 IFI=1ORI=3THENPOKECL,31:GOTO1920
                                    :rem 42
1914 POKECL,58                      :rem 38
1920 POKESL,0:FORX=1TO200:NEXT:NEXT:FORX=
     1TO500:NEXT:RETURN             :rem 182
2000 REM LINE UP SAVED CAT          :rem 190
2010 X=SC+985:POKEX-CC,60:POKECM+X-CC,7:C
     C=CC-1:SR=SR+10*AA↑2:CF=0      :rem 16
2020 POKEWF,33:FORI=1TO50:NEXT:RETURN
                                    :rem 149

9000 DATA120,8,72,152,72,138,72,173,19,14
     5,72,173,34,145,72,169,0,141,62,3,14
     1                              :rem 49
9005 DATA63,3,169                   :rem 124
9010 DATA127,141,34,145,173,32,145,73,255
     ,41,128,42,8,169,195,141,19,145,173,
     17                             :rem 115
9015 DATA145,73                      :rem 25
9020 DATA255,41,60,74,74,40,42,168,41,16,
     201,16,208,3,141,63,3,152,41,15,162,
     0                              :rem 24
9025 DATA232,224                     :rem 69

9030 DATA9,240,8,221,160,3,208,246,142,62
     ,3,104,141,34,145,104,141,19,145,104
                                    :rem 232
9035 DATA170,104                     :rem 68
9040 DATA168,104,40,88,96,2,3,1,5,4,12,8,
     10                             :rem 105
10000 DATA255,255,255,255,255,255,255,255
                                    :rem 31
10010 DATA0,0,0,0,0,15,63,255       :rem 155
10015 DATA0,0,0,0,0,240,252,255      :rem 0
10020 DATA1,1,3,3,7,7,7,7           :rem 229
10030 DATA128,128,192,192,224,224,224,224
                                    :rem 16

10040 DATA7,7,7,7,3,3,1,1           :rem 231
10050 DATA224,224,224,224,192,192,128,128
                                    :rem 18
10060 DATA255,63,15,0,0,0,0,0       :rem 160
10070 DATA255,252,240,0,0,0,0,0      :rem 1
10080 DATA128,192,224,240,248,252,254,255
                                    :rem 26
10090 DATA1,3,7,15,31,63,127,255    :rem 76
10100 DATA255,255,255,255,250,246,244,224
                                    :rem 21

10110 DATA255,255,191,63,15,15,7,63
                                    :rem 233
10120 DATA240,249,240,228,0,252,255,255
                                    :rem 170
10130 DATA255,255,127,35,1,112,63,255
                                    :rem 71
10140 DATA0,102,0,24,0,0,28,0       :rem 151
10150 DATA56,84,56,16,124,186,40,108
                                    :rem 33

10160 DATA62,42,62,28,28,28,60,120
                                    :rem 179
10170 DATA40,124,85,125,57,57,61,127
                                    :rem 32
10180 DATA0,16,124,254,214,130,0,0
                                    :rem 156
10190 DATA0,0,0,0,0,0,0,0           :rem 201
20000 JP=15-PEEK(56320)AND15         :rem 11
20010 PRINTJP:GOTO20000             :rem 127
```

Machine Language For Beginners

(Article on page 129.)

Program 2: VIC Version

```
10 I=12288                          :rem 236
20 READ A:IF A=256 THEN 50           :rem 55
30 POKE I,A:CK=CK+A:I=I+1:GOTO 20:rem 129
40 END                              :rem 59
50 IF CK<>11469 THEN PRINT "ERROR IN DATA
    STATEMENTS":STOP                :rem 196
12288 DATA 160,0,169,8,153,0,148    :rem 44
12295 DATA 153,0,149,200,208,247,160
                                    :rem 236
12302 DATA 0,169,224,153,0,16,153   :rem 75
12309 DATA 228,17,200,192,22,208,245
                                    :rem 236
12316 DATA 169,21,133,71,169,16,133
                                    :rem 191
12323 DATA 72,162,24,160,0,169,224
                                    :rem 132
12330 DATA 145,71,200,145,71,202,240
                                    :rem 219
12337 DATA 16,24,165,71,105,22,133
                                    :rem 132
12344 DATA 71,165,72,105,0,133,72   :rem 83
12351 DATA 76,38,48,169,20,133,204
                                    :rem 145
12358 DATA 32,155,224,164,98,185,149
                                     :rem 5
12365 DATA 15,201,224,240,244,169,90
                                    :rem 237
12372 DATA 153,149,15,198,204,208,235
                                     :rem 42
12379 DATA 96,256                    :rem 88
```

Program 3: 64 Version

```
10 I=49152                          :rem 236
20 READ A:CK=CK+A:IF A=256 THEN 50:rem 54
30 POKE I,A:I=I+1:GOTO 20           :rem 130
40 END                               :rem 59
50 IF CK<>12749 THEN PRINT "ERROR IN DATA
    STATEMENTS":STOP                :rem 198
49152 DATA 160,0,169,8,153,0,216    :rem 40
49159 DATA 153,0,217,153,0,218,153
                                    :rem 142
49166 DATA 0,219,200,208,241,160,0
                                    :rem 130
49173 DATA 169,224,153,0,4,153,192
                                    :rem 148
49180 DATA 7,200,192,40,208,245,169
                                    :rem 198
49187 DATA 39,133,71,169,4,133,72:rem 110
49194 DATA 162,24,160,0,169,224,145
                                    :rem 197
49201 DATA 71,200,145,71,202,240,16
                                    :rem 175
49208 DATA 24,165,71,105,40,133,71
                                    :rem 140
49215 DATA 165,72,105,0,133,72,76   :rem 95
49222 DATA 44,192,169,20,133,204,32
                                    :rem 189
49229 DATA 158,224,164,98,185,168,3
                                    :rem 222
49236 DATA 201,224,240,244,169,90,153
                                     :rem 39
49243 DATA 168,3,198,204,208,235,96,256
                                    :rem 158
```

COMPUTE!'s Gazette for Commodore

AUTHOR GUIDE

COMPUTE!'s Gazette for Commodore is looking for interesting, useful articles aimed at beginning to intermediate VIC-20 and Commodore 64 users. If you have an article idea or a good original program, we'd like to see it. Don't worry if you are not a professional writer. We are more concerned with the content of an article than its style. Simply try to be clear in your writing and check your program for any bugs.

COMPUTE!'s Gazette for Commodore is a consumer-oriented magazine for VIC-20 and Commodore 64 users who want to get the most out of their computers in a non-technical way. It is aimed primarily at home users, not all of whom necessarily want to become expert programmers. If your article covers a more advanced or technical topic, you may choose to submit it to our companion publication, **COMPUTE!**. If you submit an article to one of our magazines and we believe it would be more suitable to the other, we will transfer your submission to the right editors. The basic editorial requirements for publication are the same for both magazines; so are the payment rates.

The following guidelines will permit your good ideas and programs to be more easily edited and published. Most of these suggestions serve to improve the speed and accuracy of publication:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to either the VIC-20 or Commodore 64, please state which one. In addition, please indicate the memory requirements of programs.

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* The tape or disk should be labeled with your name and the title of the article. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

It is far easier for others to type in your program if you use CHR$(X) values and TAB(X) or SPC(X) instead of cursor manipulations to format your output. For five carriage returns, FOR I = 1 TO 5:PRINT:NEXT is far more "portable" to other computers with other BASICs and also easier to type in. And, instead of a dozen right-cursor symbols, why not simply use PRINT SPC(12)? A quick check through your program – making these substitutions – would be greatly appreciated by your editors and by your readers.

6. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing "Revision" on the envelope and the article.

7. All lines within the text of the article should be spaced so that there is about 1/2 inch between them. A one-inch margin should be left at the right, left, top, and bottom of each page. No hyphens should be used at the ends of lines to break words. And please do not justify. Leave the lines ragged.

8. Standard typing paper should be used (no onionskin or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

9. Sheets should be attached together with a paper clip. Staples should not be used.

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. *COMPUTE!'s Gazette* for Commodore pays between $75 and $1000 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance of an article. Following submission (Editorial Department, *COMPUTE!'s Gazette* for Commodore, P.O. Box 5406, Greensboro, NC 27403) it will take from four to six weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. Rejected manuscripts are returned to authors who enclose an SASE. We do not consider articles which are multiple submissions. If you wish to send an article to another magazine for consideration, please do not submit it to us.

13. Articles can be of any length – from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

14. If you want to include photographs, they should be 5x7, black-and-white glossies.

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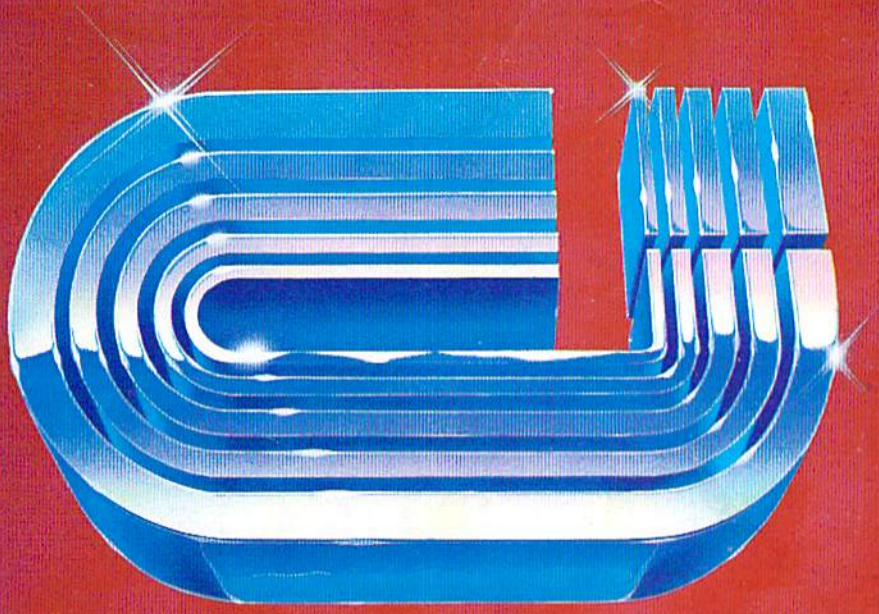

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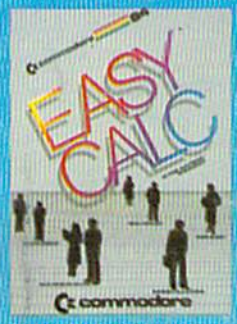

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